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# Environmental Assessment

## Waste Treatment Facility

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation.

# HAZARDOUS WASTE MANAGEMENT
# OPTIONS FOR ONTARIO

## An Analysis of Conceptual Alternatives to OWMC's Proposal

Arthur D. Little,
International, Inc.

Reference: C-54616

Final Report to:
Ontario Waste Management
Corporation
Toronto, Ontario
September 26, 1986

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September 30, 1986

1986
At the frontier
1886

Mr. David R. Young
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Dear David:

Arthur D. Little is pleased to submit the enclosed final report entitled "Hazardous Waste Management Options for Ontario," dated September 26, 1986.

On behalf of Arthur D. Little and all the participants in the project, I thank you for the opportunity to conduct this challenging assignment. Please feel free to call on us at any time for further assistance with OWMC's Facilities Development Program as it moves forward.

Sincerely,

Jeffrey M. Bass

Jeffrey M. Bass

Enclosure

Brussels
Cambridge
Houston
London
Los Angeles
Madrid
Mexico City
Milan
Paris
San Francisco
Sao Paulo
Singapore
Tokyo
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Wiesbaden

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# EXECUTIVE SUMMARY

## 1.1 PURPOSE OF THE REPORT

OWMC has proposed to establish a comprehensive, centralized special waste treatment/disposal facility as a key component of a province-wide industrial waste management system. The purpose of this report is to examine whether any alternate course of action would be superior on its overall merits.

## 1.2 SCOPE AND METHOD

The scope of work was specified by OWMC as follows:

(1) Identify and fully describe broad conceptual alternatives to OWMC's proposal.

(2) Develop evaluation criteria which relate to the OWMC's principal goals and mandate.

(3) Use the criteria to evaluate alternatives relative to OWMC's proposal with a view to preparation of recommendations.

(4) Document the study results in a final report.

Arthur D. Little, Inc. was retained to convene a diverse group of experts in the management of special wastes to serve as a study team for the project. The team met in Toronto on June 10-12, 1985, for a three day workshop at which alternatives and evaluation criteria were developed. The results of the workshop formed the basis for a draft report and additional research by team members. The team met for a second working session in Toronto on July 11-12, 1985, to refine the draft report and to develop recommendations. This report is, therefore, based primarily on independent expert judgment and opinion.

## 1.3 PREMISES AND POSTULATES

In completing the assignment, the study team accepted the following information and planning guidelines provided by OWMC as premises:

- Acceptable alternatives to OWMC's proposal must be:
    - designed to handle all types of special waste generated in Ontario;
    - consistent with OWMC's mandate;
    - technically feasible; and
    - in compliance with all applicable laws and regulations in Ontario and other affected jurisdictions (e.g., other Provinces or countries that might receive wastes generated in Ontario).
- There is a need for additional environmentally safe capacity in the Province of Ontario for incineration of approximately 30,000 t/a of organic special wastes, for physical/chemical treatment of approximately 120,000 t/a of inorganic and aqueous units, for solidification of incineration and treatment residuals, and for landfill of solidified residues.

To aid in evaluation of alternatives, the study team adopted the following postulates:

- The Ministry of Environment would take into account the special waste treatment and disposal facilities available to Ontario generators in the promulgation of new regulatory initiatives. In other words, the degree of stringency of regulations would depend significantly on the capabilities of available facilities.

- Risks to human health resulting from the operation of hazardous waste treatment and disposal facilities can be controlled to extremely low levels.

- With risks to human health under control, community impacts (other than health) assume equal and even somewhat greater importance.

## 1.4 STATUS OF DATA

Available data were adequate for the conceptual, non-site-specific assessment that was carried out. Lack of definitive data or geographic distribution of types and quantities of special wastes requiring off-site treatment/disposal limited the level of detail in the description of decentralized facility alternatives. All alternatives could be described in sufficient detail, however, to permit comparative evaluation of the underlying concepts.

## 1.5 MAIN FINDINGS

### 1.5.1 Waste Management Alternatives

The broad conceptual alternatives for management of special wastes in Ontario were found to fall into six general categories. The study team evaluated one or more representative examples in each category. These examples do not exhaust the range of possibilities, but each one is implementable, and with the exception of "No Action", each is capable of contributing to a solution to the special waste management problems of Ontario.

| | |
|---|---|
| CATEGORY 1 | |
| Alternative 1 | OWMC's Proposal |
| CATEGORY 2 | Decentralized OWMC Facilities |
| Alternative 2A | Decentralized Comprehensive Facilities |
| Alternative 2B | Decentralized Specialized Facilities |
| Alternative 2C | Decentralized Separate Treatment and Disposal Facilities |
| Alternative 2D | Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility |
| CATEGORY 3 | Specialized Central OWMC Facilities with Missing Services Provided by the Private Sector |
| Alternative 3A | Centralized OWMC Incinerator, Physical/Chemical Treatment and Solidification Facility with Private Landfill |
| Alternative 3B | Centralized OWMC Incinerator Facility with Private Physical/Chemical Treatment and Landfill |
| Alternative 3C | Centralized OWMC Incinerator, Landfill and Solidification Facility with Private Physical/Chemical Treatment |

CATEGORY 4

| | |
|---|---|
| Alternative 4 | No Action |

CATEGORY 5

| | |
|---|---|
| Alternative 5 | Continued Active Four R Program as OWMC's Only Role |

CATEGORY 6

| | |
|---|---|
| Alternative 6 | Active Support of Private Sector by OWMC. |

Alternatives in Categories 1 and 2 involve OWMC ownership and operation of a comprehensive system for treatment/disposal of all types of special wastes generated in Ontario. Alternatives in Category 3 involve OWMC ownership and operation of facilities for treatment/disposal of some (but not all) types of special wastes, with the private sector's providing other technologies necessary to constitute a comprehensive system. Alternatives in Categories 4, 5 and 6 preclude OWMC involvement in the ownership or operation of facilities. In Alternative 4, OWMC would be disbanded; in Alternative 5, OWMC's role would be limited to a Four R program; in Alternative 6, OWMC's role would be limited to active support and facilitation of the private sector in developing needed facilities. In all alternatives considered, except "No Action," OWMC would continue to pursue an active Four R program (i.e., reduction/reuse/recycling/recovery).

### 1.5.2 Evaluation Criteria

The criteria used by the study team to evaluate the defined alternatives were divided into two groups. Group A criteria evaluate how effective a given alternative would be in solving the special waste problem in Ontario. Group B criteria evaluate the human health risks, environmental impacts and costs of the alternative concepts for solving the problem; i.e., whether the solution creates more problems than it solves. Within each group of criteria, the following factors were considered:

Group A. Capability Solving Ontario's Special Waste Management Problem

A.1 Availability - Availability of adequate safe capacity for management of wastes generated in Ontario

A.2 Control - Provincial assurance that the special waste problem is under control

Group B. Effect of Solutions to the Problem on Health and Safety, Environment and Costs

B.1 Health and Safety Effects

B.1.a Effects of Facilities on Community Health and Safety

B.1.b Effects of Transportation of Special Wastes on Community Health and Safety

B.1.c Effects of Special Waste Transport, Treatment and Disposal on Worker Health and Safety

B.2 Environmental Impacts

B.2.a Impacts on Community Life

B.2.b Impacts on the Economy of the Local Community

B.2.c Impacts on the Existing Waste Management Industry

B.3 Costs

B.3.a Capital Investment

B.3.b Costs to Generators

### 1.5.3 Evaluation of Alternatives

- Based on the criteria used and the relative importance assigned to each one by the study team, no alternative course of action was found to be superior on overall merit to OWMC's proposal.

- Every alternative considered, including OWMC's proposal, had both advantages and disadvantages. These are discussed in Chapter 4.

- The principal advantage of OWMC's proposal is that it would solve the special waste problem in Ontario more safely than other alternatives; the principal disadvantages of OWMC's proposal, relative to alternatives, lie in costs and impacts on the private special waste management industry.

- The "No Action" alternative is inferior to every option considered.

- Public sector facilities are likely to have to meet higher standards and, therefore, will incur higher costs. However, all alternatives, except "No Action," are assumed to meet all applicable regulatory requirements. OWMC's proposal may be more expensive than alternatives where the private sector plays a larger role, because of high costs incurred to achieve marginal decreases in human health risks and environmental impacts.

- A strong Four R program for reduction/reuse/recycling/recovery significantly improves every alternative but is insufficient in itself to solve the special waste problem in Ontario.

- The feasibility of implementation and the effectiveness of every alternative (except "No Action") depends strongly on the evolution of special waste regulations in the Province.

### 1.5.4 Recommendations

OWMC should take or continue the following actions:

- Continue the development of its proposal as a first component of an overall hazardous waste management strategy for Ontario.

- Continue to make very careful evaluations of community impacts and health risks, including measures to mitigate impacts, based on the specifics of the selected site.

- Provide specific guarantees that no host community will suffer economic loss.

- Continue to review the Four R program for specific operational elements to enhance immediate effectiveness, make effective use of data, coordinate with future operations, and ensure, to the extent possible, that waste reduction is implemented in preference to treatment or disposal.

- Consult with the Ministry of Environment to advise on development of regulatory controls that do not impose unnecessary barriers to economic reduction and recycling of waste, and to provide positive incentives where appropriate.

- Adopt specific cost-control and value-engineering procedures in facility design.

- Adopt specific economic performance criteria on OWMC operations.

- Take the abilities of the private waste-management industry into account in facility planning and design, and explore opportunities for cooperation.

# CHAPTER 1

## BACKGROUND AND SCOPE

The primary responsibility of the Ontario Waste Management Corporation (OWMC), as stated in its Annual Reports, is "to design, construct and operate a province-wide system for the treatment and disposal of liquid industrial hazardous waste, and to develop a long term program to assist in the reduction and recycling of such wastes." OWMC has proposed that an industrial waste management system for Ontario should include as one component, a centralized facility capable of safe and efficient treatment and disposal of all special wastes generated in the province. The present study was commissioned by OWMC to obtain an independent assessment of alternatives to the proposed facility. This chapter includes:

- A summary of the background that led OWMC to request this study;
- A statement of the purpose and scope of the study as specified by OWMC; and
- A description of the methodology used by the study team to complete the assignment.

### 1.1 BACKGROUND

The Ontario Waste Management Corporation (OWMC) was formally established in July 1981, to "research, develop, establish, operate and maintain facilities for the transmission, reception, collection, examination, storage, treatment and disposal of wastes including sewage ..."(1) More specifically, Ontario Order-In-Council #OC 1076/81 charged OWMC with the responsibility for establishing and providing facilities for the treatment and disposal of "liquid industrial waste and hazardous waste." These wastes were specified by OWMC to mean "special wastes," i.e., "industrial wastes that cannot be properly dealt with in a conventional manner, by existing public facilities such as municipal sewage treatment plants, municipal incinerators and municipal landfills."(2)

OWMC's first assignment was to examine the suitability of government owned property at South Cayuga in the Regional Municipality of Haldimand-Norfolk as the location for a world-class facility for treatment and disposal of special wastes. After detailed evaluation of the site, it was found to be hydrogeologically unacceptable. The site was officially rejected in November 1981.

In accordance with Ontario Order-in-Council #OC 1985/81, OWMC then initiated a program to find a safe place for the needed facility. A five-phase Facility Development Process was developed for site selection and facility design. This process shown schematically in Figure 1, will culminate in a facility application under the Ontario Environmental Assessment Act and a public hearing before the Environmental Assessment Board. The application must include an evaluation of the advantages and disadvantages to the "environment" of the "undertaking", the alternative methods of carrying out the undertaking, and the alternatives to the undertaking.(4)*

Since 1981, well before it was subject to the Environmental Assessment Act, OWMC has conducted its facility development studies in a manner which encompasses the broad definition of "environment" given in that Act; viz:

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* Until officially brought under the Environmental Assessment Act in July 1985, the OWMC proposal was to have been submitted to a special Hearing Board as specified by Ontario Order-in-Council #OC 1706/84. The submission would have had to demonstrate:

- that the recommended site is a safe place for the proposed facility;
- that the proposal to locate the facility at the site is technologically sound, and
- that the proposed operations will be provided in an environmentally safe manner.

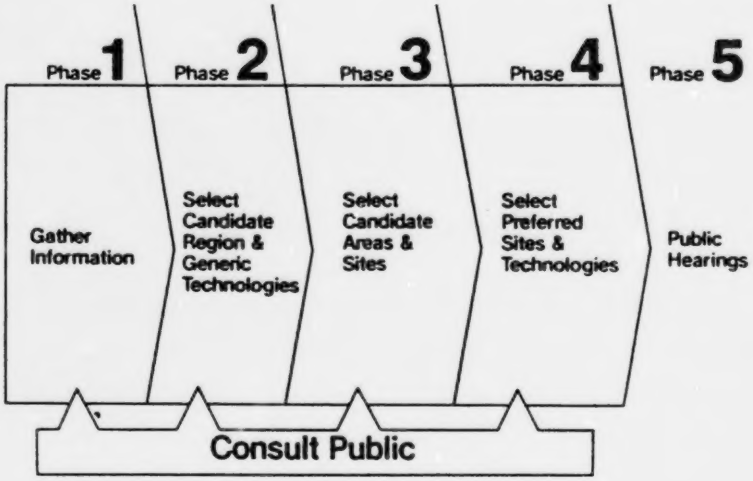
Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Gather Information
Select Candidate Region & Generic Technologies
Select Candidate Areas & Sites
Select Preferred Sites & Technologies
Public Hearings
Consult Public

FIGURE 1 FACILITIES DEVELOPMENT PROCESS .

Source: Reference (5)

- air, land or water;
- plant and animal life, including man;
- the social, economic and cultural conditions that influence the life of man or a community;
- any building, structure, machine or other device or thing made by man;
- any solid, liquid, gas, odor, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man; or
- any part or combination of the foregoing and the interrelationships between any two or more of them.

Within the context of the Environmental Assessment Act, the "undertaking" will be the OWMC proposal to establish a comprehensive, centralized special waste treatment/disposal facility at a site, designated as LF-9C, in the Township of West Lincoln in the Regional Municipality of Niagara.**

## 1.2 PURPOSE AND SCOPE OF THIS REPORT

The purpose of this report is to examine broad conceptual alternatives to the undertaking proposed by OWMC, and to determine whether any alternate course of action would be superior on its overall merits.

Conceptually, the OWMC proposal is to design, construct and operate a centralized facility with capability to treat and dispose of all

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** OWMC, Phase 4A Report Summary, September 1985, (issued after completion of the draft final report for this project) types of special wastes generated in Ontario for which proven treatment/disposal methods exist and are practically available. Alternative concepts which OWMC asked the study team to consider, included:

- decentralized facilities, collectively capable of the treatment and disposal of all types of special wastes generated in Ontario;
- an active hazardous waste reduction, reuse, recycling and recovery program as the sole component of a special waste management system for Ontario;
- development of further on-site treatment facilities for generators of special wastes;
- expansion of the private hazardous waste treatment industry;
- development of long-term or perpetual storage facilities for untreated wastes;
- shipment of untreated hazardous wastes out of province for disposal and/or treatment in other jurisdictions or at sea
- the "do nothing", "null", or "no action" alternative.

The scope of work entailed specifically:

a) examination of the issue of treatment vs. non-treatment, taking into account social responsibility and long-term environmental safety;

b) more detailed definition of the alternatives to be considered;

c) development of evaluation criteria which relate to the principal goals and mandate of OWMC;

d) evaluation of alternatives using the criteria with a view to the preparation of recommendations;

e) documentation of the study in a written technical report.

It should be noted that the focus of the study was on conceptual alternatives to the OWMC proposal. The scope of work did not encompass alternative methods of carrying out the concept proposed by OWMC. Alternative methods, such as locating the centralized facility at a different site or selecting different technologies for treatment/disposal of wastes at the preferred site, have been examined in depth by OWMC in other studies, and were not re-examined here.

## 1.3 METHODOLOGY

Arthur D. Little, International, was retained to assemble a study team with extensive knowledge in the hazardous waste management field, including an understanding of the approach being taken by different jurisdictions. Considerable reliance was placed upon the expert opinions of the independent participants in the study. They were selected for their knowledge of the hazardous waste management field, their experience in the development of hazardous waste management alternatives, and their diversity of views. Dr. Joan B. Berkowitz, Vice President of Arthur D. Little in charge of hazardous waste consulting, was the team coordinator and project manager. Her professional work has been concentrated in the field of hazardous wastes for the past 14 years. In 1983, she received the highest award of the Society of Women Engineers for her pioneering contributions to the field. The members of the team were:

- Dr. William Beranek, Jr., President, the Indiana Center for Advanced Research, Inc. and Chairman of the American Chemical Society's Committee on Environmental Improvement. Dr. Beranek is noted for his work on environmental risk assessment and policy alternatives for the management of hazardous wastes.

- Patricia Deese, Arthur D. Little. Ms. Deese is a registered professional engineer with expertise in hazardous waste treatment technologies and pollution abatement policy.

- Tom Houston, Arthur D. Little. Mr. Houston is a senior member of Arthur D. Little's Toronto office, where he specializes in the area of energy economics. He has worked for the Parliament of Canada, the Royal Commission on Prices and Income, and the Department of Finance.

- Dr. Robert Laughlin, Ontario Research Foundation. Dr. Laughlin is an internationally known expert in hazardous waste reduction, reuse, recycling and recovery, and a recognized leader in Ontario for hazardous waste science and technology.

- Dr. Robert Pojasek, Manager of Hazardous Waste Consulting, Charles T. Main Co. Dr. Pojasek has edited several books on hazardous waste and is an internationally recognized expert on the design and engineering of hazardous waste management facilities to minimize impacts on public health and the environment.

- Dr. Terry Rothermel, Arthur D. Little. Dr. Rothermel has specialized for over 10 years in the assessment of markets for equipment, technology and systems to control air emissions, waste water, solid waste and hazardous waste.

- William M. Sloan, Executive Secretary to the Maryland Hazardous Waste Facilities Siting Board. Mr. Sloan is a specialist in the siting of hazardous waste management facilities and in the assessment of need for such facilities. He is a founder of the Hazardous Waste Consortium of State and Provincial siting groups and editor of its bulletin, Solutions.

More detailed biographies of the seven participants are included in Appendix A. Study team members not employed by Arthur D. Little were engaged as independent consultants. Their organizational affiliations are given for purposes of identification only, and do not indicate participation or endorsement by their organizations.

The study team met in Toronto on June 10-12, 1985, for a three-day workshop. At this workshop, the team formulated a set of conceptual waste management alternatives, developed evaluation criteria, and made a trial evaluation. An initial report was circulated for comments to the study team and OWMC. The study team met again in Toronto in July 1985 for a two-day workshp to conduct the final evaluation. Staff and consultants of OWMC were available at both workshops to provide background information and clarification of OWMC's mandate, prior work conducted by OWMC and OWMC's proposal.

The study team identified plausible waste management alternatives through group discussion of:

- Special waste management strategies that have been implemented in jurisdictions outside of Ontario;

- Special waste management strategies known by the group to have been considered in Ontario and in other jurisdictions.

- Public comments on OWMC's proposal, as documented in previous OWMC reports and summarized for the group by OWMC.

Work of Arthur D. Little staff and consultants in the interim between workshops also contributed to the development of alternatives.

Evaluation criteria were developed from OWMC's three strategic goals which are in order of importance: to minimize risk to human health; to minimize environmental impacts; and to minimize costs to OWMC and the people of Ontario. Important factors for assessing risks, impacts and costs of conceptual alternatives were derived from criteria used by OWMC in site selection and technology evaluation studies, concerns raised by the public about hazardous waste facilities in the U.S. and Canada, and the experience of the study team. The factors were grouped into criteria, and weights were assigned to the criteria to reflect their relative importance.

Alternatives were evaluated against criteria in group discussion. First, qualitative ratings were assigned that reflected the relative merit of each alternative in comparison to OWMC's proposal for each of the criteria selected. Based on this comparison and the criteria weights, the study team developed an overall qualitative evaluation and ranking of alternatives.

Ultimately, Arthur D. Little prepared a report based on comments and results of the second workshop.

# CHAPTER 2

## OWMC's PROPOSAL AND CONCEPTUAL ALTERNATIVES

This chapter describes the essential elements of OWMC's proposal and the conceptual alternatives developed by the study team. The team started with the concepts proposed for consideration by OWMC in the scope of work of the project and listed in Chapter 1. Some of these concepts were found to be overlapping; others were found to be weak as stand-alone options but could be combined into a stronger overall concept. Finally, six concepts were more fully developed for further consideration, each with one or more variations. These concepts are:

- OWMC's Proposal
- Decentralized OWMC Facilities
- Specialized Central OWMC Facilities with Missing Services Provided by the Private Sector;
- No Action;
- Augmented Regulations by MOE and Only a Reduction/Reuse/ Recycling/Recovery (Four R) Program by OWMC;
- Active Support of the Private Sector.

### 2.1 DEVELOPMENT OF CONCEPTUAL ALTERNATIVES

Exhaustive coverage of all of the many possible conceptual alternatives to OWMC's proposal was well beyond the scope of work of this project. The study team did attempt to include representative examples of all of the broad conceptual strategies for establishing a comprehensive hazardous waste management system known to have been implemented or proposed throughout the world. A preliminary set of alternatives was developed based on the suggestions provided by OWMC in the scope of work of the project (see Chapter 1) and the experience of the study team. As discussed in the remainder of this section, alternatives, found initially to be seriously flawed were either dropped from further consideration, or revised to overcome the deficiencies. The final set of alternatives selected for further analysis are described in Section 2.2. None is totally without merit. All were recognized to have significant advantages as well as disadvantages. Each is implementable and capable of contributing to a solution to the special waste management problems of Ontario.

The following paragraphs briefly discuss each of the initial alternatives considered and their relationship to the final alternatives selected for more detailed analysis.

### 2.1.1 Decentralized Facilities Collectively Capable of Treatment and Disposal of all Special Wastes Generated in Ontario.

Almost from the beginning, OWMC has examined two basic conceptual alternatives. One is the fully integrated, centralized facility that now forms the basis for OWMC's proposal; the other is separate treatment and disposal facilities(3). In the second category, four concepts have been mentioned in the public literature. These are(12)(13):

- several fully integrated, regionally centralized systems;
- partially decentralized systems (e.g., landfill and physical/chemical treatment at one site, incineration at another; or landfill at one site and physical/chemical treatment and incineration at another; or physical/chemical treatment at one site, and landfill and incineration at another);

- a fully decentralized system (landfill at one site, physical/chemical treatment at another, and incineration at a third);

- a centralized facility with regional transfer and dewatering stations.

All of these alternatives were retained for consideration by the study team and are described more fully in section 2.2.2.

### 2.1.2 An Active Hazardous Waste Reduction/Reuse/Recycling and Recovery Program as the Sole Component of a Special Waste Management System for Ontario.

There is an emerging awareness throughout the world that waste minimization and recycling can reduce both costs and demand for new facility development. There is also universal agreement that waste reduction/reuse/recycle and recovery (known as "Four R" by the Ministry of the Environment) are the most desirable hazardous waste management methods. There are no reliable estimates, however, of the percentage reduction in hazardous waste generation that would result if all possible Four R opportunities were implemented. OWMC has found that less than 10 percent of the total waste generated is recycled and that about 1 percent is exchanged (i.e., transferred from the generator to a user via the Ontario or Canadian Waste Materials Exchange).(12) Experience elsewhere(20-23) strongly suggests that a minimum of 70 percent of the waste generated cannot be eliminated at the source and will require incineration or physical/chemical treatment, with solidification and landfill of residuals. Furthermore, even recovery processes, such as solvent recovery or metals recovery, generate residues that are generally considered to be special wastes and that would require further treatment and/or disposal. For these reasons, the study team did not think that a Four R program, in and of itself, would be appropriate as the sole component of a special waste management system. Nonetheless, most people, who participated in the public consultation component of

OWMC's Facilities Development Process, felt that helping industries to reduce and recycle wastes was an important and urgent task(11). The study team agreed. An active Four R program was, therefore, included as part of every conceptual alternative defined except for "no action" (see Section 2.2.4). The alternative of only pursuing a Four R program was also returned for further consideration to reenforce the necessity of continuing a Four R program as one component of any overall special waste management system that might be developed in the Province.

### 2.1.3 Development of Further On-Site Treatment Facilities for Generators of Special Wastes.

This alternative, as a stand-alone option, appeared to the study team to be impractical for a number of reasons. First, OWMC has estimated that there are close to 20,000 special waste generators in Ontario, of which more than 11,000 are companies with fewer than ten employees.(29) It would require an inordinate amount of time to identify the specific needs of a significant fraction of these generators and to develop a program for substantive assistance. Furthermore, on-site treatment technologies may not be available at the required scale. Second, a disproportionate financial burden would be placed on small generators who cannot take advantage of economies of scale (i.e., the general decrease in unit treatment costs as the quantity of waste treated per year increases). Third, MOE would find it difficult to write reasonable and defensible regulations requiring the use of on-site treatment, because of the high variability among wastes generated in different plants even within the same industry. Without regulations, there might be considerable resistance to acceptance of an OWMC program to develop facilities for private generators. Even if MOE were able to develop an appropriate regulatory strategy, implementation and enforcement would certainly be extremely complex. Finally, on-site incineration or physical/chemical treatment almost inevitably produces some residue for disposal. In the opinion of the study team, a large number of on-site landfills would be undesirable because of the difficulty in assuring that they are all being operated safely. Moreover, landfills could be impossible at many generator sites due to lack of space or unsuitable hydrogeologic conditions. On the other hand, on-site treatment has the strong benefit of minimizing transportation risks.

In this study, assistance to hazardous waste generators in implementing further on-site treatment was incorporated as one component of the conceptual alternative defined in section 2.2.6 as active support of the private sector by OWMC.

### 2.1.4 Expansion of the Private Hazardous Waste Treatment Industry.

This basic concept was more fully developed by the study team as described in section 2.2.6.

### 2.1.5 Development of Long Term or Perpetual Storage Facilities for Untreated Wastes.

This concept was considered to represent too high a risk to human health and environment to be considered further by the study team. Those who favor the concept are generally optimistic that, in time, technology will be developed for recovering useful values from the stored materials. The study team was particularly concerned about the risk of catastrophic damage to human health and the environment in the event of a breach in integrity of storage facilities housing highly flammable or toxic materials. The team was also concerned that if no recovery technology is currently on the horizon, it might be many years before one becomes available. If a serious accident is possible, then the longer untreated wastes remain in storage the more likely it is that an accident will occur. Even in a geologically isolated site, such as Herfa-Neurode in West Germany, flammable and reactive wastes are not accepted for long-term storage(7).

While the concept was rejected by the study team as a general or stand-alone solution for the hazardous waste problem in Ontario, the team recognized the possibility that OWMC facilities might receive a small quantity of wastes for which there is no proven treatment technology. Such wastes might be stored more safely at a centralized OWMC facility than at the site generation while treatment methods were being actively investigated.

### 2.1.6 Shipment of Untreated Hazardous Wastes Out of Province for Disposal and/or Treatment in Other Jurisdictions or at Sea.

This was rejected by the study team as a stand-alone alternative but was incorporated as a component of the concept of active support of the private sector described in section 2.2.6. Exclusive reliance on out-of-Province treatment and disposal was not thought to be generally applicable because of transportation risks, limited and eventually diminishing disposal capacity in other jurisdictions, and the possibility of prohibitions on inter-provincial and international shipment of hazardous wastes. The study team recognized that some generators may be closer to suitable out of Province facilities than to the proposed centralized OWMC facility. As a general rule, however, transportation distances to out-of-Province facilities would be longer than to Ontario facilities and, hence, the transportation risks would be greater both within and outside of the Province. The two landfills in New York State, that have received hazardous wastes from Ontario, are running out of permitted capacity and have relatively little potential for expansion.(30)

### 2.1.7 No Action

The "no action" alternative was retained for consideration by the study team because of the requirements of the Environmental Assessment Act. The features of this alternative are described in further detail in section 2.2.4.

### 2.1.8 Mobile Facilities.

This conceptual alternative was added by the study team to the seven suggested by OWMC in the scope of work. Following some discussion, the team concluded, however, that mobile or more properly, field erectable facilities would not be capable of handling all special wastes generated in Ontario. The availability of mobile treatment and incineration facilities is far too small to meet the demand.(31) Development and permitting of adequate capacity by either OWMC or the private sector would be both expensive and time consuming. Furthermore, the treatment of hazardous waste both by mobile facilities or fixed facilities always produces some irreducible residue for disposal.

### 2.1.9 Private Versus Public Ownership/Operation.

There are four variations on most of the preliminary conceptual alternatives discussed above, and the more fully defined conceptual alternatives selected by the study team for evaluation and described in section 2.2. These variations are private ownership/private operation, private ownership/public operation, public ownership/private operation and public ownership/public operation. As defined in section 2.2., the conceptual alternatives selected for analysis specify public and private roles. Possible variations on the assumed ownership and operating responsibilities are discussed at the end of Chapter 4.

## 2.2 CONCEPTUAL ALTERNATIVES SELECTED FOR ANALYSIS

This section describes the conceptual alternatives defined by the study team for further analysis. The team attempted to define alternatives that would be capable of accomplishing the same purposes as laid out in the OWMC mandate through different sizes and locations of facility components (i.e., incineration, physical/chemical treatment, solidification and engineered landfill) and/or different institutional mechanisms (public versus private ownership/operation). In particular the team attempted to specify alternatives that are:

- complete; i.e., able to accept and manage most or all types of the special wastes generated in the Province;
- feasible with respect to technology and operation;
- fully capable of implementation under law and regulations.

In developing alternatives, the study team accepted as a premise, information provided by OWMC on the quantities and types of wastes that would require off-site treatment and disposal over the next five years. The specific projections provided by OWMC are as follows:(32)

| | |
|---|---|
| • Total Provincial special waste generation | 1 500 000 t/a |
| • Special waste now managed inadequately | 500 000 t/a |
| • Anticipated decrease in inadequately-managed waste due to reduction, reuse, recycling and recovery | (-) 200 000 t/a |
| • Total facility demand (within 10 years) | 300 000 t/a |
| • Near-future facility demand (5 years) | 150 000 t/a |

OWMC estimates show the 500 000 t/a of waste now managed inadequately as being reduced by 200 000 t/a through reduction, reuse, recycling and recovery, some of which would be stimulated by OWMC's own Four R program. The remainder, 300 000 t/a, constitutes the total estimated demand. This demand is projected to develop over a 10-year period. The current OWMC proposal and the other waste management alternatives in this report were based on the "near future" demand of 150 000 t/a expected to materialize in five years.

The near-future 5-year demand estimate consists of:

- 120 000 t/a of waste of primarily inorganic character, for which physical/chemical treatment is to be provided; and

- 30 000 t/a of mainly organic waste, to be incinerated.

Residues and ash from physical/chemical and incineration units, plus solidification agents, make up most of the landfill demand. An aqueous effluent from physical/chemical treatment would need to be discharged, following analysis, to a sewer or receiving water body; solidified for placement in the landfill, or evaporated with any residue solidified for placement in the landfill.

All alternatives developed (except "No Action") are based on two key assumptions. One is that new regulatory initiatives would be developed, and that these initiatives would depend to some extent on the quality and capacity of available treatment/disposal facilities. The team's understanding is that MOE is more likely to revise standards or create greater controls as facilities become available, rather than in anticipation of such facilities. The second assumption is that a Four R program would be pursued vigorously.

### 2.2.1 Alternative 1: OWMC's Proposal

OWMC's proposal involves one integrated facility, initially comprised of:(33)

- Rotary kiln incinerator with capacity of roughly 30 000 t/a.

The incinerator would be capable, among other things, of burning organic solids, thermally processing inorganic solids with an organic contaminant, and receiving waste in plastic, fiber or steel drums.

- Physical/chemical capacity of 120,000 t/a will be achieved by having three eight hour shifts per day. The physical/chemical treatment plant would treat mainly inorganic wastes including aqueous liquids, slurries, sludges and solids. The physical/chemical treatment capability would include neutralization of acids and caustics, precipitation of heavy metals, separation of solids from liquids and oil from water, oxidation of cyanides and other reactive anions, reduction of hexavalent chromium to the less toxic trivalent form, and other physical separation and chemical destruction processes as appropriate.

- Solidification, using portland cement, sodium silicate or other comparable additives, to convert residues from the incinerator or treatment units into less readily leachable solids. The solidification agent is mixed with the treatment residue, physically encapsulates it in a solid or granular mass and, in some cases, chemically reduces the solubility of metallic components. The mixture hardens and cures within days.

- Landfill, designed to accept about 300 000 t/a of solidified treatment residuals for a period of 20 years, built to "secure" engineering specifications, and located in a geological setting in which natural features provide secondary backup to the engineered provisions.

Ancillary components to OWMC's facility would include:

- A comprehensive laboratory for waste characterization, treatability studies and rapid check-characterization of incoming shipments.

- Receiving facilities, drum handling capability, and appropriate bulk and drum storage.

- Capability for collection, holding, analysis, and treatment (or, where necessary, retreatment) of process effluents and runoff from potentially contaminated areas.

- A 50-meter buffer strip around the active landfill area and a 400-meter buffer zone around the point of emission of treatment facilities.

The facility would be designed for expansion to meet future needs. All special wastes would be accepted for treatment, storage and disposal. State-of-the-art technology would be used, and air and liquid effluent discharges would be minimized. The landfill would only accept treatment residuals.

OWMC expects a traffic volume of about 84 trucks per day(33) for waste, chemical reagent, and solidification-agent deliveries.

OWMC also expects the use or future development of transfer stations in various parts of the Province by either private firms or OWMC itself, after the central facilities are operating and the market needs can be more accurately defined.

OWMC would continue the Four R program to which it has been committed from the beginning. Past activities that would be maintained or expanded include OWMC-sponsored investigations in Ontario and Canada(8)(9), OWMC presence and statements at conferences related to the Four R concepts(10) and OWMC's support of the Ontario Waste Exchange and the Canadian Waste Materials Exchange. There is a potential conflict of interest, however, between facility development and waste reduction. In the state of Hessen in West Germany, for example, at source recycling and reclamation is actually discouraged in order to guarantee a supply of wastes for the HIM facility(7). Recommendations for a closer integration of OWMC's

Four R program and its facility development proposal are included in Chapter 5.

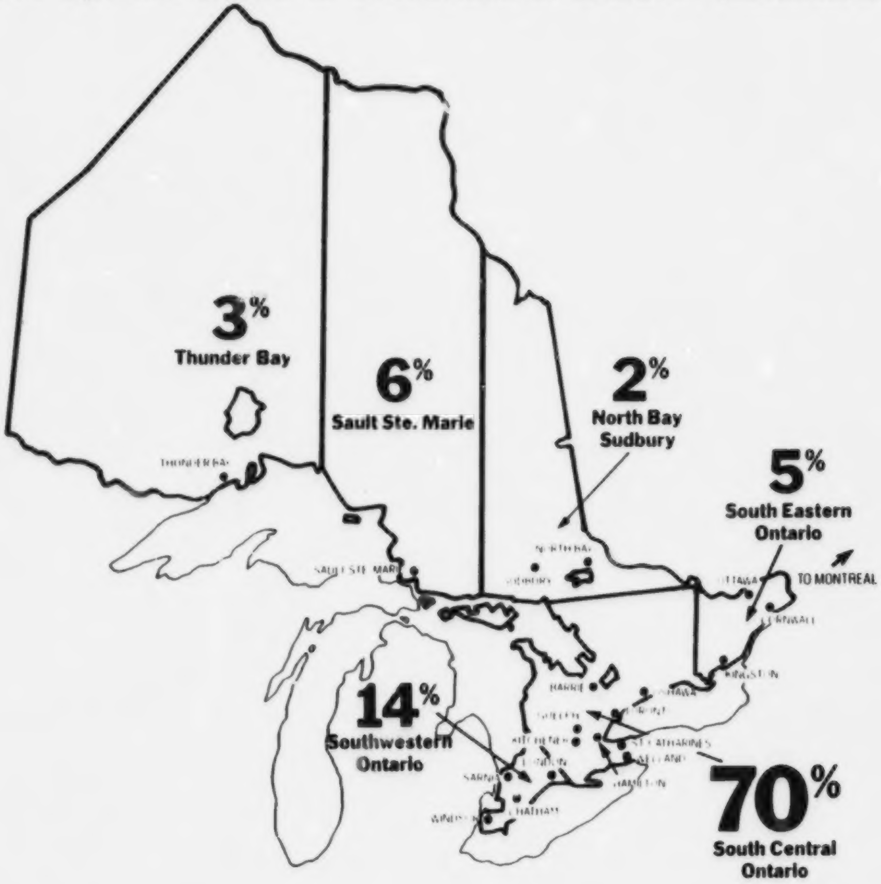
### 2.2.2. Decentralized OWMC Facilities

Four decentralized alternatives were defined, all involving OWMC ownership and operation of two or more hazardous waste treatment and/or disposal sites, and continuation of the Four R program (see Section 2.2.1).

There is some difficulty in defining decentralized facility options precisely because of the uncertainty in the types and quantities of waste generated for off-site treatment and disposal by geographic origin. Data published by OWMC show, however, that about 95% of the hazardous waste generated originates in the triangular area bounded by Windsor, Montreal and Sudbury (see Figure 2). The Windsor-Montreal axis along the MacDonald-Cartier freeway is roughly 900 km. The Toronto-Hamilton area, itself about 70 km long, lies about 540 km from Montreal. Niagara Falls, situated at the eastern edge of the Niagara Peninsula, lies about 120 km off the Windsor-Montreal axis. Sudbury lies about 540 km off the axis. In this geographic setting, all but a few percent of the special waste could be transported to a centrally located facility in about five hours.

OWMC has estimated that, of the 1 500 000 t/a of special wastes generated, 70% is in south central Ontario (concentrated in the area around Lake Ontario from Oshawa to Niagara Falls); 14% is in southwestern Ontario (London, Sarnia, Chatham and Windsor); 5% is in northern Ontario (centralized around Sault Ste. Marie); 3% is in Thunder Bay, 2% is in Sudbury and North Bay, and 5% is in southeastern Ontario (Kingston, Cornwall, Ottawa)(12). What is not known precisely is the types of wastes. OWMC has conducted market surveys and does possess a general knowledge of geographic generation sources.

Where Special Waste is Generated in Ontario (Estimated)



Source: OWMC Phase 1 Report, September 1982.

Figure 2

Alternative 2A - Decentralized Comprehensive Facilities

OWMC would develop two separately located comprehensive facilities with the same component operations and associated features described for Alternative 1 except that each would have smaller capacity. A comprehensive laboratory for characterization of waste samples prior to acceptance at either facility and for conducting treatability studies, as necessary, would only be located at one of the facilities. Both facilities would have a "fingerprint" laboratory for rapid check-characterization of incoming shipments. Each facility would be designed and operated to serve the potentially different treatment/disposal needs of different areas of the Province. These needs are not known precisely at this time. In the absence of data on specific need as a function of geographic region, it was assumed that no more than two facilities would be required, and that each would be comprised of the following operating units:

- rotary kiln incinerator with a capacity of roughly 15 000 t/a;
- physical/chemical treatment with a capacity of 60 000 t/a in an eight hour shift;
- solidification to convert residues from the incinerator and physical/chemical treatment units into less readily leachable solids;
- landfill designed for about 150 000 t/a of solidified treatment residuals for a period of 20 years, built to "secure" engineering specifications and located in a geological setting in which natural features provide secondary back-up to the engineered provisions;
- ancillary components as in Alternative 1 (OWMC's Proposal)

Since each facility is expected to receive approximately 50% of the wastes that would be received by OWMC's proposed single facility, the traffic volume into and out of each facility would be approximately 42 trucks per day. Costs would be more than twice as large as Alternative 1 because of the larger total land area required and because of the higher capital and operating costs per unit of throughput for smaller capacity facilities.

OWMC would continue with its Four R program as described for Alternative 1.

Alternative 2B - Decentralized Specialized Facilities

OWMC would develop three specialized facilities at each of three separate locations. One facility would be comprised of the following operating units:

- a rotary kiln incinerator with a capacity of about 30 000 t/a with the capabilities specified in Alternative 1;
- a laboratory for rapid check-characterization of incoming shipments;
- receiving facilities, drum-handling capability and appropriate bulk and drum storage;
- a 400 metre buffer zone around the point of stack emission;

A second facility would house the following components:

- a physical/chemical treatment plant with a capacity of 120 000 t/a in three eight hour shifts, as described in Alternative 1;
- a comprehensive laboratory for characterization of pre-shipment waste samples and for treatability studies to serve all three facilities, and for rapid check-

characterization of incoming shipments for physical/chemical treatment;

- receiving facilities, drum-handling capability and appropriate bulk and drum storage;
- capability for collection, holding, analysis and treatment (or, where necessary, retreatment) of process effluents
- a 400 metre buffer zone around points of emission from any of the physical/chemical operations;
- a solidification unit for residues received from the incinerator facility and residues generated in the physical/chemical processing units.

The third facility would be comprised of a landfill sized as in Alternative 1, built to "secure" engineering specifications and located in a geological setting that provides secondary backup containment to the engineered features. The landfill would receive residues from the solidification unit of the physical/chemical treatment facility. The landfill site would include a receiving facility and the active landfill area would be surrounded by a 50 metre buffer strip.

Traffic volume would be approximately 15 trucks per day at the incineration plant, 72 or so trucks per day at the physical/chemical treatment and solidification plant, and on the order of 27 trucks per day at the landfill.

The total required land area would be somewhat larger than in Alternative 2A. Capital and operating costs would be slightly higher than Alternative 1, due to the duplication of infrastructure, and somewhat lower than Alternative 2A, because of economies of scale.

OWMC would continue with its Four R program as in Alternative 1.

Alternative 2C - Decentralized Separate Treatment and Disposal Facilities

OWMC would own and operate a treatment facility and a disposal facility at two separate locations. The treatment facility would be comprised of:

- a rotary kiln incinerator with a capacity of about 30 000 t/a as in Alternative 1;
- a physical/chemical treatment plant with a capacity of about 120 000 t/a from three eight-hour shifts per day;
- solidification as in Alternative 1;
- a comprehensive laboratory for waste characterization, treatability studies and rapid check-characterization of incoming shipments as in Alternative 1;
- receiving facilities, drum handling capability and appropriate bulk and drum storage as in Alternative 1;
- capability for collection, holding, analysis and treatment (or, where necessary, retreatment) of process effluents;
- a 400 metre buffer zone around the emission points of the treatment units.

As in Alternative 1, the traffic volume would be about 84 trucks per day.

The second facility would contain a landfill with the associated infrastructure as in Alternative 2B. The traffic volume for solidified residuals from the treatment plant would be about 27 trucks per day.

OWMC would continue with its Four R program as in Alternative 1.

Alternative 2D - Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility.

OWMC would develop one centrally located facility with rotary kiln incineration, solidification and landfill capacity as in Alternative 1. This facility would also house a small physical/chemical treatment unit for treatment of leachate and runoff from contaminated areas; a comprehensive laboratory for characterization of pre-shipment waste samples, for treatability studies to serve all facilities, and for rapid check-characterization of incoming shipments; receiving facilities, drum handling capability, and appropriate bulk and drum storage; a 50 metre buffer strip around the active landfill area and a 400 metre buffer zone around the point of emission from the rotary kiln incinerator. Additional small physical/chemical treatment plants and associated transfer stations would be located strategically to minimize the transport of untreated wastes suitable for physical/chemical treatment. Solids and dewatered sludge residues from each of the physical/chemical treatment plants would be shipped to the centralized facility for solidification and landfill. Treated liquid effluents would either be discharged to receiving waterbodies or sewers, evaporated, or shipped to the centralized facility for solidification and landfill. Each of the satellite physical/ chemical treatment plants would include a laboratory for simple fingerprint analyses to assure that the wastes received correspond to those of the pre-shipment sample.

OWMC would continue with its Four R program as in Alternative 1.

### 2.2.3 Central Facility Less Certain Components

In this group of conceptual alternatives, the OWMC facility would lack one or two of the three major functional components of Alternative 1 (physical/chemical treatment or incineration or landfill). The missing functions would be provided by privately owned and operated facilities in response to market demand. The study team assumed that environmental regulations would be as stringent as in Alternative 1.

Alternative 3A - Centralized OWMC Incinerator, Physical/Chemical Treatment and Solidification Facility with Private Landfill

The incineration, physical/chemical treatment, and solidification units would be identical to Alternative 1, but the residues would be sent to a private Canadian landfill in Ontario. All associated operations (laboratory, drum handling, etc.) would be performed at the OWMC developed facility. There are currently two private, commercially available hazardous waste landfills in the great triangle defined by Sault Ste. Marie, Quebec City and Windsor that could potentially receive solidified residues from the OWMC facility. The Canadian destinations were considered a more realistic option than shipment to one or more of the commercial landfills in New York State. OWMC would continue with its Four R program as in Alternative 1.

Alternative 3B - Centralized OWMC Incinerator Facility with Private Physical/Chemical Treatment and Solidification, and Landfill

OWMC would develop a 30 000 t/a rotary kiln incineration facility, with associated laboratory and materials handling operations. Physical/chemical treatment and landfill would be provided by the private sector at existing facilities initially, and at expanded or new facilities that it is assumed will be developed if market demands exceeds available capacity. According to an OWMC-sponsored study, there are existing "secure" landfill and physical/chemical treatment plants in Ontario and Quebec.(28)

OWMC would continue with its Four R program as in Alternative 1.

Alternative 3C - Centralized OWMC Incinerator, Landfill and
Solidification Facility with Private
Physical/Chemical Treatment

Alternative 3C is similar in concept to Alternative 2D, except that the physical/chemical treatment plants and transfer stations would be developed and operated by the private sector rather than by OWMC.

OWMC would continue with its Four R program.

### 2.2.4 Alternative 4: - "No Action"

This is the no-change alternative described as the base case by the Guidelines to Ontario's Environmental Assessment Act.(14) This alternative must of necessity be considered under the provisions of Ontario's General Guidelines for the Preparation of Environmental Assessments. The underlying assumptions of the "No Action" alternative are:

- OWMC, instead of moving to implement its mandate, will go out of existence (OWMC's Four R program is, therefore, not a part of this alternative);

- regulatory controls and level of effort by the private sector to develop special waste facilities will remain as they are now.

### 2.2.5 Alternative 5: - Continued Active Four R Program as OWMC's Only Role

An important assumption of Alternative 5 is that MOE will implement and enforce more stringent regulations for the treatment and disposal of special wastes. This might increase the demand for hazardous waste facilities and thereby stimulate the private sector to respond to that demand. The only OWMC activity would be to continue and expand its Four R program (see Alternative 1).

### 2.2.6 Alternative 6: - Active Support of Private Sector

OWMC would conduct an active and perhaps expanded Four R program as in Alternative 5, and would also actively support development of private sector treatment/disposal capacity.

Support for the private sector might include one or more of the following types of activities:

- Joint Ventures - These might involve OWMC ownership and private operation of a centralized facility or a network of decentralized facilities. OWMC might take an equity interest in a partnership to develop needed facilities. Potential partners include private waste treatment/disposal firms, waste generators interested in getting into the business of managing wastes, and/or companies that provide on-site treatment/disposal services.

- Financial Assistance - OWMC might directly fund the purchase of on-site treatment/disposal equipment by selected generators, or provide low interest loans or guarantees for private development of proper on-site treatment systems.

- Siting Assistance - OWMC might purchase sites to be developed by the private sector, and provide both technical and financial support to the private developer(s) in preparing a proposal and defending it through the hearing process.

- Management Contract/Franchise - OWMC might contract with the private sector for ownership and operation of facilities in accordance with specified performance standards.
- Promotion - OWMC might provide moral and/or tangible support to private ventures proposed for treatment/disposal of special wastes.
- Negotiation - OWMC might negotiate with out-of-Province (including U.S.) facilities to accept wastes from Ontario in return for some guarantees on quantities or fees.

# CHAPTER 3

# CRITERIA FOR EVALUATION

This chapter describes the criteria used to evaluate and compare waste management alternatives. Section 3.1 discusses the criteria selection process; Section 3.2 defines the factors considered in determining how well the criteria are satisfied for any given conceptual alternative.

## 3.1 CRITERIA SELECTION PROCESS

OWMC's proposal to build and operate an industrial waste treatment and disposal facility has been guided by three goals(5) which are in order of priority:

(1) minimize the risk to human health

(2) minimize the impact to the environment

(3) minimize the cost to the people of Ontario.

The study team agreed that these were also appropriate goals for alternatives to OWMC's proposal. The basic questions addressed by the study team were, therefore, "Is there any alternative that presents a lower risk to human health and less of an impact on the environment at lower cost? If not, what are the explicit trade-offs among alternatives?" To answer these questions, the study team developed a set of criteria against which human health risks, environmental impacts and costs could be measured.

The team started by reviewing several sets of criteria that have been used in Ontario and elsewhere for evaluating sites for hazardous waste facilities and technologies for hazardous waste treatment/disposal. These are displayed in Appendix B. The study team concluded that the criteria reviewed are appropriate for comparing sites for defined facilities, or for comparing technologies for treatment/disposal of wastes at a given facility. The criteria reviewed were not considered totally appropriate for comparing conceptual alternatives for the development of a hazardous waste management system for Ontario.

In defining conceptual alternatives, the study team tried to develop realistic and implementable approaches to solving the problem of managing special wastes properly in Ontario. In developing criteria to compare the conceptual alternative developed, the study team felt strongly that it was important to examine the following two fundamental questions:

- How do the conceptual alternatives developed differ in their capability to solve the problem that they were designed to address?
- How do the risks to human health, impacts on the environment, and costs associated with each of the alternative conceptual solutions compare?

The first question stems directly from the premise of this study that there is, in fact, a very serious problem in need of a solution. The second question stems from the need to assure that the solution does not create a more serious problem than it is intended to solve. The evaluation criteria selected by the study team were, therefore, divided into two groups as shown in Table 1. The group A criteria measure the capability of each of the conceptual alternatives to solve the special waste management problem. The group B criteria measure the health and safety effects, the environmental impacts, and the costs of each of the alternative conceptual solutions. The criteria are defined in more detail in the following section.

## TABLE 1

## ENVIRONMENTAL IMPACTS OF WASTE MANAGEMENT SOLUTION

A. Capability of Solving Ontario's Special Waste Management Problems

- A1. Availability
- A2. Control

B. Effects of Solutions to the Problem on Health and Safety, Environment and Costs

- B1. Health and Safety Effects
  - B1a. Effects of Facilities on Community Health and Safety
  - B1b. Effects of Transportation of Hazardous Wastes on Community Health and Safety
  - B1c. Effects of Hazardous Waste Transport, Treatment and Disposal on Worker Health and Safety
- B2. Impacts of Waste Management Solution Environmental
  - B2a. Impacts on Community Life
  - B2b. Impact on the Economy of the Local Community
  - B2c. Impact on Existing Waste Management Industry
- B3. Costs
  - B3a. Need for Public Capital
  - B2b. Costs to Waste Generators

## 3.2 CRITERIA DEFINITIONS AND DISCUSSION

### 3.2.1 Group A Criteria - Capability of Solving Ontario's Special Waste Management Problems

The special waste problem of Ontario was described to the study team by OWMC as:(15)

- landfilling of inadequately treated or untreated wastes;
- discharge of inadequately treated and untreated wastes into sewers;
- dependence on facilities outside of the province that may not continue to be available to Ontario generators;
- long term storage of untreated wastes at industrial sites.

Effective solutions would, therefore, assure adequate treatment of wastes prior to landfilling or sewerage discharge and adequate treatment/disposal capacity for proper treatment/disposal of wastes generated in Ontario. Two conditions are necessary to provide such assurance. First, capacity for safe treatment/disposal of wastes generated in Ontario must be available; second, it must be operated safely and used by waste generators. Two criteria were developed to compare alternatives on their ability to provide the necessary treatment/disposal capacity and their ability to provide the people of Ontario with assurance that proper capacity is in place and that it is being operated properly. The two criteria have been called Availability and Control and are defined in the following paragraphs.

### Criteria A1 - Availability

This criterion refers to the availability of adequate, safe capacity for treatment and disposal of all types of special waste generated in the Province of Ontario. Factors considered in applying the criteria were:

- availability of sufficient treatment capacity (incineration and physical/chemical/biological treatment) to minimize the use of landfill for wastes generated in Ontario;
- adaptability to future changes in waste treatment/disposal needs of Ontario generators;
- ability to treat all types of special wastes generated in the Province safely;
- adherence to high operating and performance standards to minimize risks to human health and impacts on the environment under both normal and abnormal conditions;
- ability to provide cost effective service to generators in all parts of the Province.

### Criteria A2 - Control

This criterion refers to the degree of assurance that will be provided to the people of Ontario that wastes are, in fact, being properly managed. Factors considered in applying this criterion include:

- ease of implementation and enforcement of strict standards of performance by MOE;

- time frame for development of necessary capacity; the sooner an alternative can be implemented, the sooner unsound waste management practices can be stopped.

- assurance of continued availability of adequate treatment/ disposal capacity for Ontario generators over the long term.

### 3.2.2 Group B Criteria - Effects of Solutions to the Problem on Health and Safety, Environment, and Costs

#### Criteria Group B1 - Health and Safety Effects

Risk is the potential for undesired consequences as the result of an activity or event. Risks to human health and safety in the transport, storage, treatment and disposal of hazardous wastes stem from the potential for release of hazardous materials from transport vehicles, storage containers and treatment/disposal facilities. Releases can lead to fire and explosion, or to human exposure to contaminant levels in excess of toxic thresholds via inhalation of airborne contaminants, ingestion of contaminated surface water or groundwater, direct skin contact or ingestion of contaminated food chain species. Releases can occur as the result of transportation related spills or accidents, stack emissions or fugitive emissions from normal operations, treatment or disposal process upsets, equipment failure or control system failure. The populations at risk are communities in proximity to hazardous waste treatment/disposal facilities, communities surrounding the transportation routes used to bring wastes to such facilities, and the workers who handle and transport special wastes.

Three criteria were developed to evaluate the health and safety effects of conceptual hazardous waste management alternatives. The first relates to the effects of treatment/disposal of special wastes on community health and safety; the second relates to the effects of transportation of special wastes on community health and safety, the third relates to the effects of both transportation and treatment/disposal of special wastes on worker health and safety.

Criterion B1a - Effects of Special Waste/Treatment Disposal Facilities on Community Health and Safety

This criterion refers to risks to community health and safety due to releases from special waste treatment/disposal operations as the result of both normal activities and abnormal accidents or incidents. Factors considered in applying this criterion include:

- the inherent toxicity or hazard of the waste constituents or treatment products that potentially could be released;
- the mobility of constituents that could be released in air, groundwater and surface water;
- the number of persons potentially affected;
- measures taken to prevent the migration of contaminants outside of the buffer zone of the facility;
- mitigating measures and emergency response procedures in place to minimize effects on the surrounding communities in the event that a release does occur.

Criterion B1b - Effects of Transportation of Special Wastes on Community Health and Safety

This criterion pertains to risk to human health and safety in communities located along transportation routes used by trucks carrying hazardous wastes from sites of generation to treatment/disposal facilities. Probabilities of transportation accidents and conditional probabilities of a release in the event of an accident are very well documented(24). Accidents are not responsible for all transportation related releases. Some result from in-transit spills or leaking valves, and in loading and unloading. Factors considered in applying this criterion include:

- total tonne-kilometres traveled;

- type of waste transported (Transport of flammable liquids represents the greatest risk due to the potential for fire and explosion; releases of other liquids represent somewhat less risk but do have the potential to migrate to both surface water and groundwater before complete cleanup can be accomplished; spills of high solids content sludges and non-reactive solids represent the least risk because migration from the spill site will be relatively slow and cleanup can generally be accomplished before serious damage occurs.)

### Criterion B1c - Effects of Hazardous Waste Transport, Treatment and Disposal on Worker Health and Safety

This criterion refers to risks to worker health and safety due to the transportation, treatment and disposal of hazardous wastes. Factors considered in applying this criterion include:

- number of workers who could be potentially exposed;

- health and safety training provided to workers;

- surveillance or auditing programs in place to ensure adherence to health and safety standards.

Criteria Group B2 - Environmental Impacts of Waste Management Solution

OWMC directed the study team to use the broad definition of environment given in the Environmental Assessment Act(6). Therefore, criteria for evaluation of environmental impacts must include not only scientific, technological and economic factors but also tangible and intangible impacts on the affected communities. The study team defined affected communities to include both the localities of treatment/disposal facilities and communities located in proximity to transportation corridors. Three criteria were developed to reflect the impacts (i.e., changes from the baseline or status quo), of the various conceptual alternatives on the quality of life in affected communities, the economy of the local community and the private waste management industry.

Criterion B2a - Impacts on Community Life

This criterion refers to the influence of a new facility on the quality of life in the community's hosting the facility proper and in other localities affected by access routes or peripheral activities. Factors considered in applying this criterion include:

- physical effects such as noise, dust, odor, visual intrusion, congestion and dislocation that affect the character of a community but do not pose a direct health threat;
- perceptual effects (i.e., awareness of the facility's existence in the individual's sphere of normal life which is itself an influence on the quality of life);
- number of facilities and, hence number of affected communities. (The study team had observed that the very existence or

proposal of a hazardous waste facility has some tangible, physical effects on the community. These effects seem to depend more importantly on the perceived presence of the facility than on the size of facility.)

- effects that an individual will see, hear and feel in everyday life. (The incremental effects of new facilities were considered key. Thus the burden of a new unit was not offset by the relief from closing an existing facility. Communities that have grown accustomed to an existing facility were not considered comparable to those in which a new facility would be located.)

Criterion B2b - Impact on the Economy of the Local Community

This criterion refers to the additional revenues and expenditures that might accrue to local government due to the operation of a hazardous waste/treatment disposal facility, the increased employment of local people and the effect on property values. Factors considered in applying this criterion include:

- increased revenues from property taxes, fees or subsidies;
- increased operating expenditures to provide roads, utilities, and emergency services;
- percentage increase in local employment;
- effect on property values.

Criterion B2c - Impact on Existing Waste Management Industry

This criterion refers to the effects of the various conceptual alternatives on the existing industry for transport, treatment and disposal of special wastes. This industry includes haulers, recyclers, operators of off-site treatment/disposal facilities and manufacturers of equipment for on-site treatment of special wastes. With few exceptions, the treatment industry consists of private firms.

### Criteria Group B3 - Costs

Two criteria were developed to measure the costs of providing the level of service defined in the conceptual waste management alternatives. These criteria are related to expenditures of public capital and costs to waste generators.

### Criterion B3a - Need for Public Capital

This criterion pertains to the magnitude of public capital required to implement each of the various conceptual alternatives. In applying the criterion, only new investment was considered. Capital recovery factors were not incorporated. The prime consideration was the total draw on public capital available for Ontario investment.

### Criterion B3b - Costs to Waste Generators

This criterion pertains to the unit costs incurred by generators for waste treatment and disposal. Factors considered in applying this criterion include:

- Costs of providing safe treatment/disposal capacity;
- ability to set prices to cover costs without the need for public subsidy.

# CHAPTER 4

## EVALUATION OF CONCEPTUAL HAZARDOUS WASTE MANAGEMENT ALTERNATIVES

This chapter compares the relative merits of each of the conceptual hazardous waste management alternatives considered against the evaluation criteria developed. Section 4.1 reviews the methodology used. Section 4.2 presents the results of the analysis, and Section 4.3 discusses the findings.

### 4.1 METHODOLOGY

The following four-step methodology was used to evaluate options against criteria:

(1) Weighting factors were assigned to each criterion to reflect its relative importance. First, 100 points were distributed among the two criteria groupings (A and B). Next, the total points assigned to each group were allocated among individual criteria within the grouping.

(2) Conceptual alternatives were rated qualitatively on each of the evaluation criteria. The qualitative ratings used were as follows:

| Symbol | Description |
|---|---|
| >> | Much better than OWMC's proposal |
| > | Better than OWMC's proposal |
| -/> | Slightly better than OWMC's proposal |
| - | About the same as OWMC's proposal |
| -/< | Slightly worse than OWMC's proposal |
| < | Worse than OWMC's proposal |
| << | Much worse than OWMC's proposal |

(3) The alternatives were then compared on a factor-by-factor basis to identify the major differences or tradeoffs between them.

(4) Next, a preliminary ranking of alternatives was developed by assigning an overall score to each alternative, taking into account criteria ratings and weights. The preliminary ranking was then reviewed by the study team and a final ranking of alternatives in order of preference was developed by consensus.

## 4.2 RESULTS OF THE ANALYSIS

### 4.2.1 Weighting of Evaluation Criteria

Weights assigned to the criteria are summarized in Table 2 and discussed below. The rationale is based on the study team's experience and knowledge of hazardous waste facility siting, operation and management, review of other criteria and understanding of OWMC's goals.

Capability of solving the waste management problem (Group A Criteria) was considered by all the study participants to be of fundamental importance in deciding among conceptual alternatives; 45 points out of a maximum of 100 was allocated to it. Solving the problem is the basic mission assigned to OWMC by the Ontario Legislature. Within Group A, Capacity Availability, A1, was considered to be twice as important as A2, Provincial Control.

The side effects of solving the problem (Group B Criteria) were considered to be of approximately equal importance within the context of this study and were assigned 55 points out of a maximum of 100. The Group B criteria pertain to risks to human health,

## TABLE 2

## WEIGHTING OF CRITERIA*

| CRITERIA | DESCRIPTION | WEIGHTS | |
|---|---|---|---|
| Group A | Capability of Solving Ontarios the Special Waste Management Problem | | 45 |
| A1 | Availability | 30 | |
| A2 | Control | 15 | |
| Group B | Effects of Solutions to the Problem on Health and Safety, Environment and Costs | | 55 |
| B1a | Effects of Facilities on Community Health and Safety | 8 | |
| B1b | Transport Risks | 7 | |
| B1c | Worker's Health and Safety | 5 | |
| B2a | Impacts on Community Life | 15 | |
| B2b | Employment | 5 | |
| B2c | Impacts on the Existing Waste Management Industry | 5 | |
| B3a | Public Investment | 5 | |
| B3b | Costs to Generators | 5 | |

*See Table 1 on Page 34 for listing and more complete description of criteria effects on quality of life and costs of the various conceptual alternatives or strategies for solving the overall problem.

Group B1, health and safety risks, was assigned a weight of 20 points out of 55. These are possible events with low probability of occurrence, but potentially high consequences (serious illness, injury or death), if they were to occur. The study team believed that these risks are controllable. In fact, the Group A criteria also give heavy weight to conceptual alternatives that are most likely to lead to the development and use of safe treatment/disposal methods and that are most amenable to Provincial surveillance to assure their safety. Group B2, quality of life and community impact, was assigned a weight of 25 out of 55. This reflected the group's opinion that effects seen, heard and felt in everyday life are important determinants of the life and overall health of the communities affected.

The cost grouping, B3, received only 10 points out of 55 reflecting the majority view of the study team that cost and economic considerations are of lesser importance than protecting health, the environment and community values.

Allocation of the 20 points of Group B1 gave 8 points for criterion B1a, (risk to the community of a fixed facility); 7 points to criterion B1b, (risk from transportation); and 5 points to criterion B1c, (risk to worker health and safety). This division reflects the judgement of the workshop on the probability of occurrence and the consequences of occurrence of chronic and acute events. The B1c weight was lowest because participants judged that worker risks can be controlled more readily than community risks and that workers can be insured against potential damages. Insurance is not generally available for the community. There is also the element of consent in that a worker has the choice of where he works and in so doing accepts the conditions of his employment. The community is not afforded an analogous choice. B1a was rated slightly higher than

B1b because the potential consequences of accident appeared to be somewhat greater at a fixed facility than in transport, as a result of the larger quantities of waste potentially involved. However, transport accidents and incidents are more likely to occur, and damages that do occur obviously cannot be limited within property boundaries owned by the responsible party, as is often the case with damages resulting from accidents or incidents at fixed facilities.

In allocating the 25 points assigned to Group B2, the study team considered criterion B2a (impacts on community life) to be the most important of the three criteria because the nuisances, inconveniences and dislocations associated with the introduction of a waste treatment/disposal facility are of greatest concern to citizens of a host community; 15 points were allocated to B2a. Economic impacts on community infrastructure and standard of living were given only 5 points, because the team assumed that the host community would be compensated for any additional costs related to providing the municipal services required by any waste treatment/disposal facility. OWMC has indicated a willingness to discuss appropriate compensation arrangements for those in the immediate vicinity of a facility who have experienced demonstrated financial loss due to potentially depressed land values.(13) More generally, OWMC has accepted the principle of compensation for people who are directly affected by OWMC's activities.(16) In the U.S., many states require prospective private developers to negotiate a compensation package with the host community as a condition of facility approval(17), and the experience of the team has been that developers tend to view compensation of the host community (within reason) as a normal cost of doing business.

The conceptual waste management alternatives considered in this study affect both the capacity and the competitive environment of the existing waste treatment industry. Workshop participants were divided on the relative importance of the potentially adverse impact that an OWMC facility might have on private sector initiatives. The majority considered this to be a less important consideration in the overall evaluation of the different alternatives. Nonetheless, this issue has been raised by the existing industry as part of OWMC's public consultation program. The specific concern has been that OWMC would compete aggressively for all special wastes through its pricing and marketing policies.(13) The OWMC position has been that it will not unnecessarily duplicate adequate treatment services offered by the private sector.(18)

Within Group B3, the study team assigned equal importance to B3a and B3b, need for public capital and costs to generators respectively.

### 4.2.2 Comparison of Alternatives

The results of evaluating conceptual waste management alternatives against criteria are summarized in Table 3. OWMC's proposal was taken as the baseline for comparison, and by definition was assigned a rating of - for all criteria. The rationale for the ratings of each alternative is presented in Table 4.

In developing the ratings, the study team applied the following general principles:

- The Group 3 Alternatives (3A, 3B and 3C), which partially rely on existing private sector facilities, were considered to provide less assurance that necessary capacity would be available when needed, than alternatives where OWMC would either develop (1, 2A, 2B, 2C, 2D) or actively promote the development of (6) such capacity. The study team was concerned that private facilities might close for financial or other reasons, and that new capacity would not be developed in time to serve emerging future needs. Alternatives where total reliance would be placed on the private sector to develop facilities in response to perceived market

## TABLE 3

## RATING OF WASTE MANAGEMENT ALTERNATIVES AGAINST EVALUATION CRITERIA

| | | ALTERNATIVES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EVALUATION CRITERIA | WEIGHTING FACTORS | DECENTRALIZED COMPREHENSIVE 2A | DECENTRALIZED SPECIALIZED 2B | SEPARATE TREATMENT AND DISPOSAL 2C | MANY PHYS/CHEM TREATMENT; CENTRAL LANDFILL AND INCINERATOR 2D | OWMC INCINERATOR AND TREATMENT, PRIVATE LANDFILL 3A | OWMC INCINERATOR, PRIVATE TREATMENT AND LANDFILL 3B | OWMC INCINERATOR AND LANDFILL; PRIVATE PHYS/CHEM TREATMENT 3C | NO ACTION 4 | CONTINUED FOUR R PROGRAM ONLY 5 | PRIVATE SECTOR SUPPORT 6 |
| A. Solving the Problem | | | | | | | | | | | |
| A1 Availability | 30 | =/> | = | = | = | =/< | < | =/< | << | < | = |
| A2 Control | 15 | =/< | = | = | = | =/< | < | < | << | < | < |
| B. Risks, Impacts and Cost of Solution | | | | | | | | | | | |
| B1 Health and Safety | | | | | | | | | | | |
| B1a Facilities | 8 | =/< | = | = | = | = | = | = | << | < | < |
| B1b Transport | 7 | > | < | = | > | = | < | < | > | = | = |
| B1c Workers | 5 | < | = | = | = | = | = | = | < | = | = |
| B2 Quality of Life | | | | | | | | | | | |
| B2a Community Life | 15 | < | < | < | < | = | > | > | >> | = | < |
| B2b Employment | 5 | > | = | = | > | = | < | =/< | < | = | = |
| B2c Existing Industry | 5 | < | = | = | < | > | > | > | > | >> | >> |
| B3 Cost | | | | | | | | | | | |
| B3a Public Investment | 5 | << | < | = | < | > | > | > | >> | > | > |
| B3b Costs to Generators | 5 | < | < | = | > | > | = | = | > | > | > |

## TABLE 4 - EVALUATION OF ALTERNATIVES

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 2A<br>Decentralized Comprehensive Facilities | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| | A1 - Availability<br>Somewhat better than the proposal because of built-in redundancy; if one facility were out of service for any reason, wastes might be handled at another. | -/> |
| | A2 - Control<br>Somewhat worse than the proposal because of additional time requirements to design and engineer a scaled down rotary kiln incinerator, and evaluate the suitability of two additional landfill sites. | -/< |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>Somewhat worse than the proposal because the chance of accident at each facility is the same, and the combined chance of accident at, at least, one of the facilities is greater. | -/< |
| | B1b - Transport Risks<br>Better than the proposal because special wastes would be transported over shorterdistances. | > |
| | B1c - Workers Health and Safety<br>Less protective because the small rotary kilns may not accept whole drums of organic wastes, and shredding the drums (albeit under an inert nitrogen blanket) in order to feed wastes to the incinerator, offers higher potential for accident and worker exposure. | < |
| | B2a - Impacts on Community Life<br>Worse than the proposal because more communities would be affected. | < |
| | B2b - Employment<br>Better than the proposal because more jobs would be created. | > |
| | B2c - Impact on the Existing Waste Management Industry<br>Worse than the proposal because of the greater local presence. | < |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 2A<br>Continued | B3a - Public Investment<br>Much more costly than the proposal because of larger land area requirements, loss of economies of scale, and duplication of services. | << |
| | B3b - Costs to Generators<br>Higher unit treatment/disposal costs ($/tonne) at the smaller facilities would more than off-set somewhat decreased transportation costs. | < |
| Alternative 2B | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| Decentralized Specialized Facilities | A1 - Availability<br>Equivalent to the proposal because the same incineration, physical/chemical treatment, solidification and landfill capacity would be developed. | = |
| | A2 - Control<br>Equivalent to the proposal. | = |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>Equivalent to the proposal because the same operations are carried out on the same types and quantities of wastes. | = |
| | B1b - Transport Risks<br>Worse than the proposal because of additional transport between facilities (e.g., incineration and treatment residuals to landfill) | < |
| | B1c - Worker Health and Safety<br>Same as the proposal because the same operations are involved. | = |
| | B2a - Impacts on Community Life<br>Worse than the proposal because of the larger number of communities affected. | < |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 2B | GROUP A CRITERIA - SOLVING THE PROBLEM (continued) | |
| (continued) | B2b - Employment<br>About the same as the proposal because separating facility components would add few additional jobs. | = |
| | B2c - Impact on the Existing Waste Management Industry<br>About the same as the proposal because the same services would be created. | = |
| | B3a - Public Investment<br>Worse than the proposal because costs would be greater to develop three sites than one and because there will be some duplication of infrastructure. | < |
| | B3b - Costs to Generators<br>Worse than the proposal because increased development costs and increased costs to transport residuals will be passed on. | < |
| Alternative 2C | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| Decentralized Separate Treatment and Disposal Facilities | A1 - Availability<br>Equivalent to the proposal because the same capacity would be developed. | = |
| | A2 - Control<br>Equivalent to the proposal. | = |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>Equivalent to the proposal because the same technologies, waste, and waste quantities are involved. | = |
| | B1b - Transportion Risks<br>Equivalent to the proposal because the additional transport would only involve solidified treatment residuals with low potential for release. | = |
| | B1c - Worker Health and Safety<br>Equivalent to the proposal because the same operations would be carried out. | = |
| | B2a - Impacts on Community Life<br>Worse than the proposal because two communities rather than one would be | < |

Table 4 - Evaluation of Alternatives (continued)

| OPTION | EVALUATION | RATING |
|---|---|---|
| Alternative 2C | GROUP A CRITERIA - SOLVING THE PROBLEM (continued) | |
| (continued) | B2b - Employment<br>About the same as the proposal because the additional infrastructure and transport would create few additional jobs. | = |
| | B2c - Impact on the Existing Waste Management Industry<br>About the same as the proposal because the same services would be created. | = |
| | B3a - Public Investment<br>About the same as the proposal because treatment and disposal functions can be separated with little dupliction of infrastructure. | = |
| | B3b - Costs to Generators<br>About the same as the proposal since the additional costs for transport of treatment residuals would be small relative to overall treatment/disposal costs. | = |
| Alternative 2D | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility | A1 - Availability<br>Equivalent to the proposal because equivalent capacity would be developed. | = |
| | A2 - Control<br>Equivalent to the proposal. | = |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>About the same as the proposal because the same wastes would be treated in similar ways. | = |
| | B1b - Transportation Risks<br>Better than the proposal because significant quantities of liquid wastes would be transported over shorter distances. | > |
| | B1c - Worker Health and Safety<br>About the same as the proposl because the same wastes would be treated in similar ways. | = |

Table 4 - Evaluation of Alternatives (continued)

| OPTION | EVALUATION | RATING |
|---|---|---|
| Alternative 2D | GROUP A CRITERIA - SOLVING THE PROBLEM (continued) | |
| (continued) | B2a - Impacts on Community Life<br>Worse than the proposal because many more communities would be affected. | < |
| | B2b - Employment<br>Better than the proposal because many additional jobs would be created by the multiple, small physical/chemical treatment facilities. | > |
| | B2c - Impact on the Existing Waste Management Industry<br>Worse than the proposal because of the greater local presence. | < |
| | B3a - Public Investment<br>Worse than the proposal because of the higher costs of establishing multiple small physical/chemical treatment plants. | < |
| | B3b - Costs to Generators<br>Better than the proposal because of significantly reduced transport costs and the relatively small economies of scale associated with physical/chemical treatment. | > |
| Alternative 3A | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| Centralized OWMC Incinerator, Physical/ Chemical Treatment and Solidification Facility with Private Landfill | A1 - Availability<br>Somewhat worse than the proposal because the adequacy and long-term availability of the private landfill is uncertain. | =/< |
| | A2 - Control<br>Somewhat worse than the proposal because the private landfill could accept untreated wastes from sources other than the OWMC treatment facility, regulations may be more difficult to enforce and at the end of some post-closure period (30 years in the U.S.), liability is likely to pass to the Province. | =/< |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 3A | GROUP B CRITERIA - RISKS IMPACTS AND COSTS OF THE SOLUTION | |
| (continued) | B1a - Effect of Facilities on Community Health and Safety<br>Equivalent to the proposal assuming that regulations adequately protective of human health are implemented and enforced. | = |
| | B1b - Transportation Risks<br>Equivalent to the proposal because wastes with the highest intrinsic hazards will go to the OWMC facility as in the proposal. | = |
| | B1c - Worker Health and Safety<br>Equivalent to the proposal because strict regulations adequately protective of worker health and safety are assumed to be implemented and enforced. | = |
| | B2a - Impacts on Community Life<br>Equivalent to the proposal because one new OWMC facility would still be sited, and perceived effects are not likely to be reduced because of the absence of a landfill; the communities abutting the existing landfill are assumed to have acclimated to its presence and would not perceive a major change if additional, solidified treatment residues from the OWMC facility were accepted for disposal. | = |
| | B2b - Employment<br>Equivalent to the proposal because the types and sizes of treatment/disposal capacity would be the same. | = |
| | B2c - Impact on the Existing Waste Management Industry<br>Better than the proposal because of the additional revenues to the owner/operation of the private landfill. | > |
| | B3a - Public Investment<br>Better than the proposal because the substantial cost of developing a secure landfill would not be incurred. | > |
| | B3b - Costs to Generators<br>Better than the proposal because the private sector is assumed to be more economically efficient and to pass on some fraction of the lower operating costs to generators. | > |

Table 4 - Evaluation of Alternatives (continued)

| OPTION | EVALUATION | RATING |
|---|---|---|
| Alternative 3B<br>Centralized OWMC Incinerator Facility with Private Physical/ Chemical Treatment and Landfill | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| | A1 - Availability<br>Worse than the proposal because proper physical/chemical tretment might not be provided for all treatable wastes and because continued availabilty of landfill capacity is uncertain. | < |
| | A2 - Control<br>Worse than the proposal because the Province would have less assurance that wastes are being managed safely. | < |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>About the same as the proposal because it is assumed that regulations, adequately protective of human health, will be implemented and enforced. | = |
| | B1b - Transportation Risks<br>Worse than the proposal because the physical/chemical treatment plant outside of Montreal was assumed to be used initially, which would increase overall transportation distances for relatively high hazard liquid wastes. | < |
| | B1c - Worker Health and Safety<br>About the same as the proposal because operations are similar and regulations adequately protective of worker health and safety are assumed to be implemented and enforced. | = |
| | B2a - Impacts on Community Life<br>Better than the proposal because of the decreased truck traffic at the new OWMC facility with elimination of physical/chemical treatment; wastes for physical/chemical treatment at an out-of-Province plant were assumed to be transported over road presently used for that purpose and, hence, abutting communities would not perceive major changes in quality of life. | > |
| | B2b - Employment<br>Worse than the proposal because fewer jobs would be created by OWMC and a significant fraction of the wastes would go to an out-of-Province facility. | < |
| | B2c - Impact on the Private Waste Management Industry<br>Better than the proposal because of increased revenues to the private sector. | > |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 3B | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| (continued) | B3a - Public Investment<br>Better than the proposal because costs would be limited to development of a rotary kiln incineration facility and associated infrastructure. | > |
| | B3b - Costs to Generators<br>About the same as the proposal because of the increased transport costs of liquid wastes over longer distances and presumed decreased treatment/disposal costs at a private facility. | = |
| Alternative 3C | CRITERIA GROUP A - SOLVING THE PROBLEM | |
| Centralized OWMC Incinerator, Landfill and Solidification Facility with Private Physical/ Chemical Treatment | A1 - Availability<br>Somewhat worse than the proposal because proper treatment might not be provided for all treatable wastes. | =/< |
| | A2 - Control<br>Worse than the proposal because the Province would have less assurance that wastes are being managed safely. | < |
| | B1a - Effects of Facilities on Community Health and Safety<br>About the same as the proposal because the incinerator will receive the same quantities of flammable wastes which are generally considered to pose the highest risk. | = |
| | B1b - Transportation Risks<br>Worse than the proposal because large quantities of liquid wastes would be transported over large distances for physical/chemical treatment. | < |
| | B1c - Worker Health and Safety<br>About the same as the proposal because operations are similar and regulations adequately protective of worker health are assumed to be implemented and enforced. | = |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 3C | CRITERIA GROUP B - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| (continued) | B2a - Impacts on Community Life<br>Better than the proposal because of the decreased truck traffic at the OWMC facility (Alternative 3B). | > |
| | B2b - Employment<br>Somewhat worse than the proposal because fewer workers will be needed to run the more limited OWMC facility. | =/< |
| | B2c - Impact on the Existing Waste Management Industry<br>Better than the proposal because additional revenues will flow to the private sector for physical/chemical treatment. | > |
| | B3a - Public Investment<br>Better than the proposal because of the savings on the physical/chemical treatment plant. | > |
| | B3b - Costs to Generators<br>About the same as the proposal because of increased transport costs and presumed lower physical/chemical treatment costs because of the greater private sector role. | = |

Table 4 Evaluation of Alternatives (continued)

| OPTION | EVALUATION | RATING |
|---|---|---|
| Alternative 4 | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| No Action | A1 - Availability<br>Much worse than the proposal because historical experience has shown that the necessary capacity will not develop without active promotion by the public sector. | << |
| | A2 - Control<br>Much worse than the proposal because the people of Ontario will not be able to track the disposition of special wastes. | << |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>Much worse than the proposal because the wastes will continue to be generated and will, in effect, go to unidentified, unregulated "facilities" that are unlikely to have the community safeguards incorporated into the proposal. | << |
| | B1b - Transportation Risks<br>Better than the proposal because the wastes are not likely to be hauled any significant distances. | > |
| | B1c - Worker Health and Safety<br>Worse than the proposal because high standards of worker protection are not likely to be maintained at unidentified, unregulated "facilities". | < |
| | B2b - Impacts on Community Life<br>Much better than the proposal because there will be no perceived changes. | >> |
| | B2b - Employment<br>Worse than the proposal because no new jobs will be created. | < |
| | B2c - Impact on the Existing Waste Management Industry<br>Better than the proposal because there will be no threat of competition. | > |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 4<br>(continued) | B3a - Public Investment<br>Obviously much better than the proposal (without taking into account major expenditures that might be incurred to clean up presently unknown "facilities" that receive wastes). | >> |
| | B3b - Costs to Generators<br>Better than the proposal because costs of loosely regulated tretment and disposal that may not meet the highest standards of safety are generally lower than they would be at an OWMC facility. | > |
| Alternative 5 | CRITERIA GROUP A - SOLVING THE PROBLEM | |
| Continued Active Four R Program as OWMC's Only Role | A1 - Availability<br>Worse than the proposal because undue optimism tends to develop that treatment/disposal capacity will not be needed. | < |
| | A2 - Control<br>Worse than the proposal because wastes not amenable to reduction/reuse/recycling/reclamation will continue to be generated without the possibility for adequate surveillance by MOE. | < |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>Worse than the proposal because unknown, poorly controlled "facilities" will continue to be used instead of a highly visible, closely-controlled facility. | < |
| | B1b - Transportation Risks<br>About the same as the proposal because stricter regulations which are assumed to be implemented under this alternative should encourage use of the better existing facilities. | = |
| | B1c - Worker Health and Safety<br>About the same as the proposal because of the assumed increased stringency in regulation and enforcement | = |

Table 4 - Evaluation of Alternatives (continued)

| ALTERNATIVE | EVALUATION | RATING |
|---|---|---|
| Alternative 5<br>(continued) | B2a - Impact on Community Life<br>About the same as the proposal because it was assumed that a more stringent regulatory climate would stimulate some private facility development. | = |
| | B2b - Employment<br>About the same as the proposal because of new jobs created by an expanded Four R program and by some private facility development. | = |
| | B2c - Impact on the Private Waste Management Industry<br>Much better than the proposal because of the stimulus of augmented regulations and the lack of competition for OWMC in facility development. | >> |
| | B3a - Public Investment<br>Better than the proposal because no costs will be incurred for facility development. | > |
| | B3b - Cost to Generators<br>Better than the proposal because the private sector is presumed to be able to provide lower cost services. | > |
| Alternative 6 | GROUP A CRITERIA - SOLVING THE PROBLEM | |
| Active Support of Private Sector by OWMC | A1 - Availability<br>About the same as the proposal because of the active support presumed to be provided by OWMC in addition to augmented regulations. | = |
| | A2 - Control<br>Worse than the proposal because the time frame for development will be longer and the degree of assurance that private waste treatment/disposal facilities are operating safely will be less. | < |
| | GROUP B CRITERIA - RISKS, IMPACTS AND COSTS OF THE SOLUTION | |
| | B1a - Effects of Facilities on Community Health and Safety<br>Worse than the proposal because of the likely larger number of facilities, higher overall chances of accident and a larger number of people potentially impacted; internal standards may also not be quite as high. | < |

Table 4 Evaluation of Alternatives (continued)

| OPTION | EVALUATION | RATING |
|---|---|---|
| Alternative 6<br>(continued) | B1b - Transportation Risks<br>About equal to the proposal because similar quantities of waste are expected to be transported over similar distances. | = |
| | B1c - Worker Health and Safety<br>About equal to the proposal because regulations adequate for worker protection are likely to be implemented and enforced. | = |
| | B2a - Impact on Community Life<br>Worse than the proposal because of the presumed larger number of private facilities that will be developed. | < |
| | B2b - Employment<br>About the same as the proposal because new facilities of approximately similar capacity are expected to be developed. | = |
| | B2c - Impact on the Existing Waste Management Industry.<br>Much better than the proposal because growth of the industry would be stimulated actively. | > |
| | B3a - Public Investment<br>Better than the proposal because promotional costs would be lower than facility development costs. | > |
| | B3b - Costs to Generators<br>Better than the proposal because of assumed economic efficiency of the private sector. | > |

demands (4, 5) were deemed to have a high risk of not providing the necessary capacity in a timely fashion.

- Alternatives where OWMC would develop facilities (1, 2A, 2B, 2C, and 2D) were judged to be more amenable to Provincial control than ones where total or partial reliance would be placed on the private sector (3A, 3B, 3C, 4, 5, and 6). Control of transportation was considered to be a problem for alternatives where substantial quantities of liquid wastes could be shipped out of Province (3B, 3C, and 6). Control of treatment and disposal operations was considered to be a problem for alternatives where there is a possibility that all facilities would not be known to the MOE (4 and 5).

- OWMC was considered to be more likely than the private sector to take measures above and beyond regulatory requirements, to protect the health and safety of host communities. On the other hand, it was assumed that regulations adequately protective of public health and safety would be in place with all alternatives, except "No Action."

- If all other factors were equal, preferred alternatives would be those that minimized the transportation of liquid and flammable wastes.

- The overall impact on community life was judged to decrease with a decrease in the number of host and abutting communities that would perceive or sense the effects of facilities or transport of wastes. The principle of equity (sharing the burden of hazardous waste facilities among many communities) has been proposed in the literature(34) and was acknowledged by the study team as possibly being politically expedient. Political expediency, however, was not considered to relate to any of OWMC's three strategic goals.

- The private sector was considered likely to provide lower cost services than OWMC because of a greater emphasis on economic efficiency.

### 4.2.3 Ranking of Alternatives

It is apparent that each alternative considered has its own set of strengths and weaknesses. A preliminary rank ordering of alternatives was developed by an ad hoc numerical analysis of the ratings and weights given in Table 3. The procedure and results are described in Appendix C. The preliminary ordering provided one input to the study team's deliberations on the relative merits of the conceptual alternatives examined. A second and more important input were the qualitative summaries of advantages and disadvantages shown in Tables 5 - 15.

The final ranking of alternatives is shown in Table 16. The rationale for this ordering is discussed in the remainder of this section.

The ability of an alternative to solve the special waste problem in Ontario was weighted very heavily by the study team. Based on the assigned ratings in Table 3, the study team did not judge any alternative as clearly superior to OWMC's proposal in its ability to solve the problem. Furthermore, no alternative appeared to represent a significantly lower risk to human health or the environment. OWMC's proposal was, therefore, ranked #1.

Three alternatives were judged to be clearly inferior to OWMC's proposal on the Group A criteria. These alternatives are 3B (Centralized OWMC Incinerator Facility with Private Physical/Chemical Treatment and Landfill), 4 (No Action), and 5 (Continued Active Four R Program as OWMC's Only Role). Since the study team had identified no clear advantages to any of these three alternatives in protecting human health and the environment, they were selected as the three

## TABLE 5

## ALTERNATIVE 1 - OWMC'S PROPOSAL

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Integrated facility offering maximum degree of technical control | Traffic congestion |
| Maximum flexibility to utilize facility components to treat wastes, residues and effluents from processing components | No specific provision for directing wastes to recycling or recovery if applicable |
| Optimal opportunity to continue to develop expertise on waste treatment, reduction and recovery for assisting industry | Concentration of impacts on a single community |
| Optimal size for process control and staff management | Potentially negative effects on private waste treatment and disposal industry |
| Close interaction between the laboratory and operations staff | |
| Potentially positive effects on private waste haulers | |

## TABLE 6

## ALTERNATIVE 2A - DECENTRALIZED COMPREHENSIVE FACILITIES

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Built in redundancy | Compounded site selection problem and associated delays |
| Reduced transport distances | Loss of economies of scale |
| Shared burden among communities | More communities affected |
| Increased employment | Higher overall risks of accidents |
| | Increased requirements for skilled operational and management expertise |
| | Relatively high cost |
| | Large land area requirements |

## TABLE 7

## ALTERNATIVE 2B - DECENTRALIZED SPECIALIZED FACILITIES

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Less congestion/traffic at each facility | More complex transportation network, and increased transportation overall |
| Shared burden among communities | More communities affected |
| | Larger land area requirements |
| | Duplication of basic infrastructure |
| | Higher cost than OWMC's proposal |

## TABLE 8

## ALTERNATIVE 2C - DECENTRALIZED SEPARATE TREATMENT AND DISPOSAL FACILITIES

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Shared burden among communities | More communities affected |
| | Some duplication of infrastructure |
| | Increased transport, but of treated wastes |

## TABLE 9

## ALTERNATIVE 2D - MANY DECENTRALIZED PHYSICAL/CHEMICAL TREATMENT UNITS WITH A SINGLE INCINERATION AND LANDFILL FACILITY

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Decreased transport of untreated liquid wastes | Interference with the private sector |
| Increased employment | Higher public investment than OWMC's proposal |
| Increased convenience and lower costs to generators | |

## TABLE 10

## ALTERNATIVE 3A - CENTRALIZED OWMC INCINERATOR, PHYSICAL/CHEMICAL TREATMENT AND SOLIDIFICATION FACILITY WITH PRIVATE LANDFILL

| ADVANTAGES | DISADVANTAGES |
|---|---|
| No "new" landfill required | Potential public liabilities due to past practices at private landfill |
| Stimulation of private sector in Ontario | Uncertain responsibility for long term care |
|  | Private firm could cancel contract, leaving OWMC with no access to landfill for residuals |
|  | Private firm might need modification of permit for different waste and larger capacity |

## TABLE 11

## ALTERNATIVE 3B - CENTRALIZED OWMC INCINERATOR FACILITY WITH PRIVATE PHYSICAL/CHEMICAL TREATMENT AND LANDFILL

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Very small volume to landfill in Ontario (essentially limited to residues from OWMC incinerator and on-site treatment facilities) | Increased transportation of hazardous liquid wastes |
| Takes advantage of existing capacity | Loss of self-sufficiency in Ontario |
| No "new" landfill required | Less flexibility to handle unique or hard-to-treat wastes |

## TABLE 12

## ALTERNATIVE 3C - CENTRALIZED OWMC INCINERATOR, LANDFILL AND SOLIDIFICATION FACILITY WITH PRIVATE PHYSICAL/CHEMICAL TREATMENT

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Assured access to landfill | Increased transportation of hazardous liquid wastes |
| Smaller sized landfill required in Ontario | Loss of self-sufficiency in Ontario |

## TABLE 13

## ALTERNATIVE 4 - NO ACTION

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Saves public monies | Uncertain risks to human health and the environment |
| Avoids changes in community life | Inconsistent with OWMC's mandate |
| Avoids competition with the private sector | May leave some generators (especially smaller companies) without an acceptable option |
|  | May not adequately provide for the treatment/disposal needs of the Province |
|  | Leaves solution to a problem of serious public concern to whims of the market and private section decision |
|  | Likely to delay imposition of stringent regulations |
|  | Loss of OWMC's Four R program |

## TABLE 14

## ALTERNATIVE 5 - CONTINUED ACTIVE FOUR R PROGRAM AS OWMC's ONLY ROLE

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Avoids potential conflict between promoting waste reduction and assuring an adequate supply of wastes for planned facilities | No assurance that acceptable options will become available for wastes that cannot be reduced, reclaimed, reused or recycled |
| Low cost | |
| Avoids competition with the private sector | |

## TABLE 15

## ALTERNATIVE 6 - ACTIVE SUPPORT OF PRIVATE SECTOR BY OWMC

| ADVANTAGES | DISADVANTAGES |
|---|---|
| Provides incentives to the private sector to develop needed facilities | Lesser degree of public sector control |
| Puts Government in a positive role in support of the private sector | May not meet real needs of Ontario for timely facility development |
| Assures Government influence on private industry capacilities | Province may end up assuming all marginal risks and none of the benefits |
| | Could be perceived as too important to be left to the private sector |

## TABLE 16

## FINAL RANKING OF ALTERNATIVES

| RANK | | ALTERNATIVE |
|---|---|---|
| 1 | 1 | OWMC's proposal |
| 2 | 2D | Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility |
| 3 | 3A | Centralized OWMC Incinerator, Physical/Chemical Treatment and Solidification Facility with Private Landfill |
| 4 | 2C | Decentralized Separate Treatment and Disposal Facilities |
| 4 | 3C | Centralized OWMC Incinerator, Landfill and Solidification Facility with Private Physical/Chemical Treatment |
| 4 | 6 | Active Support of Private Sector by OWMC |
| 5 | 2A | Decentralized Comprehensive Facilities |
| 6 | 2B | Decentralized Specialized Facilities |
| 7 | 3B | Centralized OWMC Incinerator Facility with with Private Physical/Chemical Treatment and Landfill |
| 8 | 5 | Continued Active Four R Program as OWMC's Only Role |
| 9 | 4 | No Action |

lowest ranking alternatives. As a result of the heavy weighting assigned to solving the problem, Alternative 4 (No Action) ranked last. Not only would this alternative not solve the problem, but the overall risks to community and worker health and safety would be greater than OWMC's proposal. Next, the study team compared Alternative 3B with Alternative 5. Alternative 3B, in which OWMC would both provide incineration services and an active Four R program was judged to be somewhat better than Alternative 5, in which OWMC would only pursue an active Four R program. Rotary kiln incineration capacity is in short supply in both Canada and the U.S., and is considered by the study team to be the safest available technology for treating certain types of organic chemical wastes that are not amenable to reduction, reuse, recycling or recovery (e.g., still bottoms from solvent recovery operations and residues from purification of organic chemical products). Under Alternative 5, more stringent regulations might stimulate the private sector to provide the needed incineration capacity, but the Province cannot be assured that this will happen in a timely fashion.

Alternative 2D (Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility) was second in order of preference, after OWMC's proposal. Alternative 2D was judged equally capable of solving the problem. Although the public investment required would be higher, the decreased transportation risk was considered to be an important benefit. Furthermore, costs to generators would be potentially lower.

Alternative 3A, in which the OWMC facility would provide incineration, physical/chemical treatment and solidification services, while relying on a private landfill, was ranked #3. Direct involvement of the private sector and the likelihood of achieving equivalent protection of human health and environment at lower costs were judged to be important benefits that partially off-set concerns about long-term Provincial liability and continued availability of adequate landfill capacity.

Next, in order of preference, were Alternatives 2C, 3C and 6, which were considered equal in overall rank (#4). Alternative 2C is equivalent to the OWMC facility, except that the landfill would be at one site, and the incinerator, physical/chemical treatment and solidification facilities would be at another. The team did not identify any important benefits of this configuration to offset the one significant disadvantage of directly impacting two communities rather than one. Balancing the advantages and disadvantages of Alternatives 3C and 6, the study team concluded that those options were about equal in overall merit to Alternative 2C

Alternatives 2A and 2B, the decentralized comprehensive and decentralized specialized options, were ranked next in overall merit. Both are more costly than OWMC's proposal. The additional costs of Alternative 2A provide the additional benefits of slightly decreased transportation risks, more jobs and multiple treatment/disposal units; these additional benefits are offset, however, by increased risk to community and worker health and safety, compounded siting problems, slightly decreased control and somewhat increased threat to private industry. The additional costs of Alternative 2B provide no additional benefits, increased transportation risks and greater impact on community life because of the three communities affected.

## 4.3 DISCUSSION

The six highest ranking alternatives considered are arrayed in the form of a decision tree in Figure 3. From the point of view of providing a solution to the hazardous waste problem in Ontario, OWMC's proposal is the preferred alternative. If, for reasons of equity(34), it appears important to involve more than one host community, the choices in order of preference are 2D (Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility) and 2C (Decentralized Separate Treatment and Disposal Facilities). Both of these alternatives involve development of all

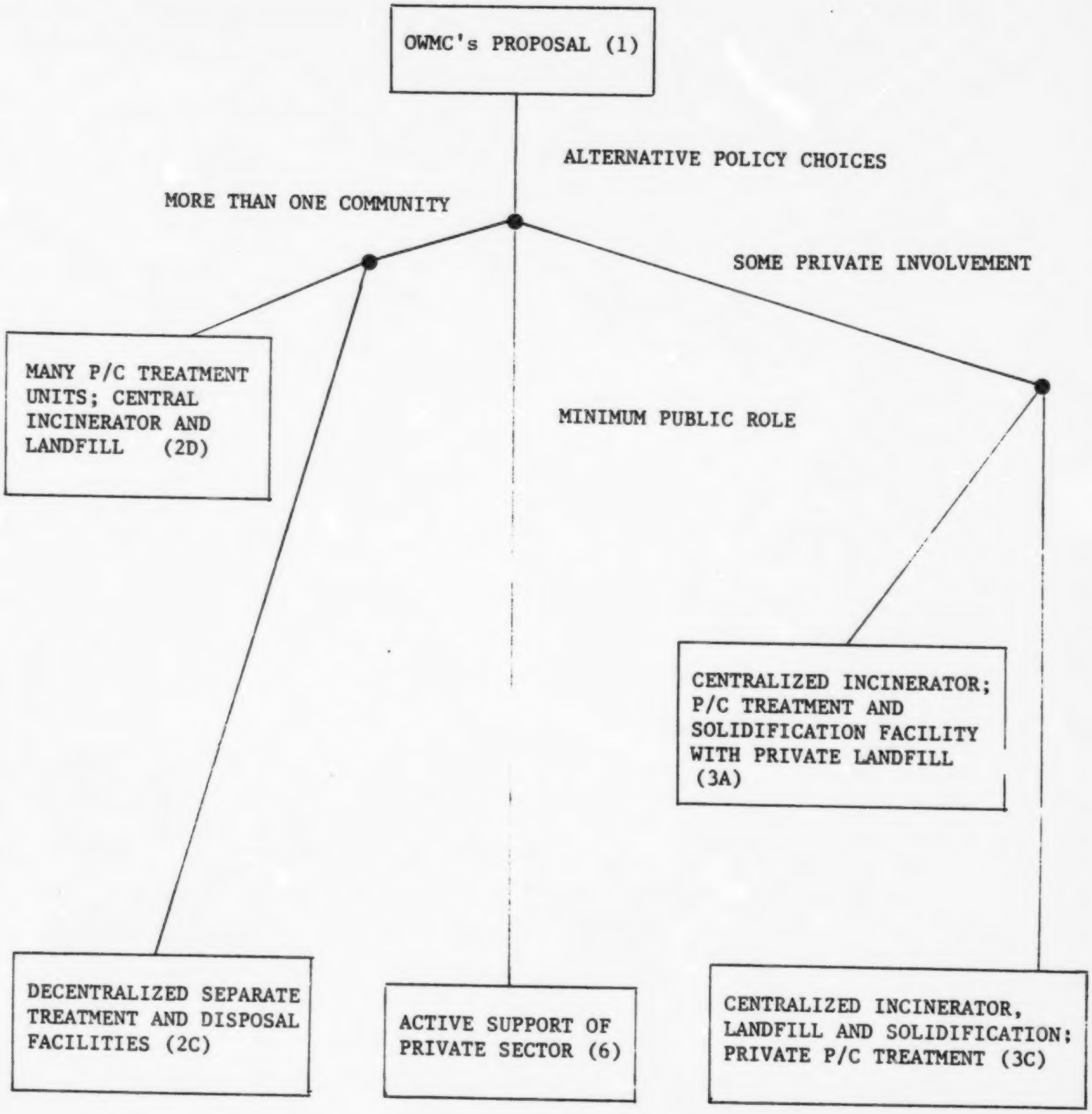

OWMC's PROPOSAL (1)
ALTERNATIVE POLICY CHOICES
MORE THAN ONE COMMUNITY
SOME PRIVATE INVOLVEMENT
MANY P/C TREATMENT UNITS; CENTRAL INCINERATOR AND LANDFILL (2D)
MINIMUM PUBLIC ROLE
CENTRALIZED INCINERATOR; P/C TREATMENT AND SOLIDIFICATION FACILITY WITH PRIVATE LANDFILL (3A)
DECENTRALIZED SEPARATE TREATMENT AND DISPOSAL FACILITIES (2C)
ACTIVE SUPPORT OF PRIVATE SECTOR (6)
CENTRALIZED INCINERATOR, LANDFILL AND SOLIDIFICATION; PRIVATE P/C TREATMENT (3C)

FIGURE 3 TREE OF CONCEPTUAL ALTERNATIVES

needed facilities by OWMC. If joint public and private involvement is considered desirable, the choices, in order of preference, are 3A (Centralized OWMC Incinerator, Physical/Chemical Treatment and Solidification Facility with Private Landfill) and 3C (Centralized OWMC Incinerator, Landfill and Solidification Facility with Private Physical/Chemical Treatment). If there is a shift in basic policy from public sector to private sector facility development, the choice would be 6 (Active Support of the Private Sector by OWMC). Alternatives (2C), (6) and (3C), each reflecting a different policy choice, were judged to be on a par with each other in overall merit, but not as good as OWMC's proposal.

Every alternative involving the development of one or more OWMC facilities (1, 2A, 2B, 2C, 2D, 3A, 3B and 3C) assumes public ownership and public operation. There are three other possible ownership/operation scenarios as follows:

(1) Public Ownership/Private Operation

(2) Private Ownership/Public Operation

(3) Private Ownership/Private Operation.

Public ownership and private operation (perhaps on a contract basis) offers the dual advantage of stable, public financial backing over the long term and experienced, private sector day-to-day management of the physical facilities. Private ownership and public operation would offer little advantage. Although there would be a possibility for recovering some of the public development costs in the short term, the public sector would have to assume ownership in the long term to protect public health and welfare if the private owners were to abandon the facility. Private ownership and private operation would be a variant on Alternative 6 and would have similar attendant disadvantages.

It is important to note that none of the alternatives considered ranked higher than OWMC's proposal in its potential for solving the problem that OWMC was created to solve. No alternative would provide greater protection of community or worker health and safety. Decentralization and geographic dispersion of physical/chemical units (Alternative 2D) or multiple comprehensive facilities (Alternative 2A) would reduce transportation risks, but have other off-setting disadvantages.

The study team discussed community impact at length. At first it appeared that larger facilities would have greater impacts than smaller ones because they would occupy more land, rise higher and create more traffic. On further reflection, the very fact of being selected to host a facility perceived to be very dangerous, regardless of its size, was judged to be the pre-eminent consideration.

It is the rare community that wants a hazardous waste treatment/ disposal facility and that meets the stringent locational criteria established by OWMC for site selection. Therefore, if any facilities are developed by anyone, anywhere, the quality of life in one or more communities will be impacted. On the other hand, if no facilities are developed (as in the "No Action" alternative), the health and safety of many communities is threatened. Thus, while the study team assigned a great deal of importance to impacts on community life, and particularly the fear that develops when a community is proposed as the site for a hazardous waste facility, the alternatives that had the lowest impacts (3B, 3C, and 4) also were least capable of solving the problem.

Hazardous waste facilities create relatively few job opportunities. In a depressed community with high unemployment, even a few new jobs and associated ripple effects in the local economy can be a major benefit. Since this study was not site specific, such benefits could not be totally evaluated.

The relative roles of public and private sectors in solving the hazardous waste problem is principally a matter of public policy. From its inception, OWMC has interpreted its mandate as requiring public ownership and operation of facilities, rather than providing incentives to private industry to do so. To pursue a philosophically different approach at this time (as in Alternative 6) would only delay establishment of the necessary facilities. If privatization becomes a major Provincial priority, private operation and even private ownership of OWMC's facility can be pursued at a later time. On the other hand, many would argue that safe management of hazardous wastes is too important to protection of health and welfare to be transferred completely to the private sector.

# CHAPTER 5

## RECOMMENDATIONS

The study team found OWMC's proposal to be superior in overall merit to any of the broad conceptual alternatives considered. The team therefore recommends that OWMC proceed with its Facility Development Process, including presentation of its proposal for review under the Environmental Assessment Act.

Although clearly superior on overall merit, OWMC's proposal is not uniformly superior on each individual evaluation criterion. In the opinion of the study team, the following recommendations might further strengthen the proposal. For the most part, the recommendations are to add emphasis to certain aspects of the proposal and do not represent an alternate course of action.

The study team strongly endorses OWMC's plans to examine in detail impacts of its proposed facility on the immediate host community, and on other communities that might be affected by facility operations or transport of wastes to the facility. The team recommends continued involvement of the potentially affected community(ies) in the design and execution of this impact analysis. Any issue of real or perceived concern to the community(ies) should be covered by the analysis to the extent possible. Any such issue not addressed, should be acknowledged openly with a clear explanation of why it could not be covered fully. Since community impacts involve feelings as much as facts, it is important for key OWMC staff to continue to be accessible to members of the community and approachable by them.

Detailed evaluation of community impacts should be one component of a strong effort to identify and apply mitigation measures. It is difficult to identify, much less decide, on appropriate mitigation without participation of those directly affected. Current thought suggests that, without action to mitigate community concerns, facility development will be close to impossible and, even if accomplished, implementation may leave lasting scars with the local governments and people of the area.

A recent report(35) defines three classes of mitigation measures, as follows:

- Preventive measures to avoid occurrence of an adverse impact in the first place;
- Measures to reverse an adverse impact; i.e., to prevent irreversible and irretrievable losses;
- Compensatory measures to provide those affected with one type of benefit as compensation for other kinds of benefits lost.

Clearly, prevention is the first line of defense, and compensation will not be effective if members of the community believe they are being 'bought off' to accept a facility they perceive as dangerous(35).

The Four R progam has been a major component of OWMC's activities since its inception, and has recently been strengthened by staff additions. The study team recommends further integration of the Four R program with the Facility Development program. Specific steps might include:

- Establish systematic procedures for transferring information (with due safeguards for proprietary interests) to generators of special wastes on specific reduction/reuse/recycling/reclamation opportunities suggested by the on-going Four R programs, the experience of the Canadian and other waste exchanges, the planning data acquired by OWMC, and treatability data obtained by OMWC once a facility commences operation.

- To the extent consistent with its mandate, refuse access to an OWMC facility if the generator has not given evidence of bonafide consideration of Four R possibilities (by showing, for instance, that the firm has tried a waste exchange, employed a qualified private surplus-material broker, or conducted a waste minimization audit according to a specified procedure.)

- Consult with the Ministry of the Environment and other affected constituencies to urge development of regulations to encourage reduction/reuse/recycling/reclamation and to avoid unnecessary barriers.

- Establish procedures for frequent formal review of the existing Four R program and adoption of additional measures to enhance its effectiveness.

The study team endorses OWMC's plans to examine the need for additional transfer treatment stations, based on the types, quantities and sources of wastes actually received at its central facility. In concept, transfer/treatment stations close to sources of waste generation could reduce transportation risks and provide more effective service for small generators.

The final recommendation is to clarify further the roles of OWMC and the private sector within an overall system for safe and cost effective management of special wastes in the Province.

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# APPENDIX A

# STUDY TEAM BIOGRAPHIES

WILLIAM BERANEK, JR.

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Dr. William Beranek, Jr., is Senior Environmental Scientist at the Indianapolis Center for Advanced Research, Inc., where he is Director of the Indianapolis Environmental Research Service. The Service is active in projects as directed by the Technical Advisory Committee of the Indianapolis Chamber of Commerce. Among these projects include mediation between the City of Indianapolis and industry regarding SO2, categorical standards for the Department of Public Works Industrial Surveillance Division, Environmental Advice to the Office of the Mayor and the Directors of the Department of Public Works and Department of Public Safety, advice to the City with regard to their proposed resource recovery facility, as well as the issue of groundwater monitoring in Marion County. Dr. Beranek is Chairman of the Marion County Hazardous Materials Advisory Council and Regional Hazardous Materials Council. He is also extremely active within the American Chemical Society, serving as Chairman of its Committee on Environmental Improvement, Chairman of its OSHA Task Force and a member of the RCRA Task Force.

Formerly Associate Director of Holcomb Research Institute at Butler University, Indianapolis, Indiana. Dr. Beranek received a B.S. in chemistry from the University of Wisconsin (1967) and a Ph.D. in chemistry from the California Institute of Technology (1973). He worked two years as a biochemical postdoctoral research fellow at the Duke University Medical Center. He has extensive experience with Indiana corporations, federal, state and local government agencies and public interest groups, working to establish technical sound policy on environmental issues such as toxic substances control, hazardous waste and hazardous materials, regulatory decisions and compliance capabilities, as well as air and water pollution and the issue of hazardous waste disposal siting, and risk analysis of Superfund sites.

Dr. Beranek is also President of Beranek Associates, Inc., an Indiana based environmental consulting firm which specializes in state-wide conferences on hazardous waste management and regulatory issues.

JOAN B. BERKOWITZ

Dr. Berkowitz is Vice President and the Environmental Practice Leader at Arthur D. Little, Inc. Since joining Arthur D. Little in 1957, Dr. Berkowitz has directed and participated in many multi-disciplinary projects involving fate and effects of chemicals in the environment, water quality modeling, environmental impact analysis and risk assessment. She has concentrated her efforts in the area of solid and hazardous waste disposal.

She is principal author of an EPA report on physical, chemical and biological treatment methods for the management of hazardous wastes. This report was published in hardcover in its entirety by Noyes Data in 1978. Dr. Berkowitz directed the first regional study of hazardous waste generation and facility needs. The work was done for the New England Regional Commission in 1979, and has had a significant influence on the development and implementation of hazardous waste management plans in the New England states and elsewhere in the U.S. Building on this initial work, she performed an analysis for the State of Maryland on types and quantities of hazardous wastes manifested in 1980, 1981, and 1982, the need for additional recovery, treatment and disposal capacity, and associated costs. She has also developed marketing data for commercial companies interested in the hazardous waste management business.

Dr. Berkowitz has visited numerous plants that generate hazardous waste and a large fraction of the commercial facilities that treat, store and dispose of hazardous wastes. Many of these visits have been made to assist companies in determining whether they are in compliance with laws, regulations, and corporate policies applicable to the management of hazardous wastes.

For the U.S. Army Biomedical Research and Engineering Laboratory, Ft. Detrick, Dr. Berkowitz directed the preparation of problem definition studies for 16 chemicals of environmental concern. For the U.S. EPA, Cincinnati, Dr. Berkowitz directed a field study on the environmental impacts of land treatment of industrial sludges at six operating sites.

For the Army, Dr. Berkowitz did a technical and economic assessment of methods for cleaning up an inactive chemical dump site at Rocky Mountain Arsenal that had begun to leach toxic materials to groundwater. One part of the same work involved preparation of a hydrogeological map of groundwater flow, and conceptual designs, including costs of upgradient diversion and downgradient interception and treatment barriers to prevent migration of contaminants across the Arsenal boundary. She also directed a program to develop a computerized model of the transport of contaminants from landfills to ground and surface water, and the ecology.

JOAN B. BERKOWITZ (continued)

Dr. Berkowitz is a nationally recognized expert in the hazardous waste management field. During her recent term as President of the Electrochemical Society, she lectured on her hazardous waste work at local section meetings throughout the U.S. and Canada. She was an invited speaker at the Symposium commemorating the opening of Louisiana State University's hazardous waste research center. In 1982, she presented the keynote address at the National Solid Waste Management Association Convention on the subject "Hazardous Wastes of the 80's". She is a member of the RCRA Task Force and the Committee on Environmental Improvement of the American Chemical Society.

In June, 1983, Dr. Berkowitz received the prestigious National Achievement Award by the Society of Women Engineers for her work in the field of hazardous waste management.

Dr. Berkowitz holds a B.A. in Chemistry from Swarthmore College, and a Ph.D. in Physical Chemistry from the University of Illinois.

PATRICIA L. DEESE, P.E.

Ms. Deese is a member of the Environment Management Section at Arthur D. Little, Inc. She is a registered professional engineer with expertise in technical and policy aspects of environmental management.

For a multi-client study of business opportunities in hazardous waste management, Ms. Deese reviewed biological treatment processes with particular emphasis on systems utilizing genetically engineered organisms. In assisting a large public utility select appropriate technologies for a hazardous waste management facility, Ms. Deese evaluated biological components. This review included a matching of appropriate waste stream, an assessment of treatability, climatic and risk associated with abnormal events for activated sludge, deep shaft, powdered activated carbon, pure oxygen, lagoon, trickling filter, and anaerobic reactor systems.

As assistant project manager, Ms. Deese directed development of a plan for closing the Texaco Canada Montreal refinery site in an environmentally sound manner. The closure plan included an analyses of possible contamination, fate and effects risk assessment analyses, development action alternatives. Ms. Deese participated in data collection and analysis and had primary responsibility for report production. She also evaluated effectiveness of containment for the U.S. Office of Technology Assessment.

Ms. Deese participated in a detailed assessment of waste disposal alternatives for a private client. This study was completed with design and construction of an industrial process water treatment facility. For the USEPA, Ms. Deese directed site visits to 45 solid waste landfills throughout the country. She has visited and evaluated industrial pretreatment facilities at over 30 plants.

Ms. Deese is an expert on management of industrial waste water and hazardous wastes. She is currently working for a Fortune 100 company on liabilities resulting from management of hazardous wastes.

Ms. Deese participated in a Department of Energy study on the socio-economic and environmental impacts of major energy facilities construction. As a design engineer, Ms. Deese designed public utility systems and supervised construction. A number of projects involved construction in areas with high water table or rock ledge.

She has contributed to two major EPA studies on siting of major facilities, with particular emphasis on public participation and education. She recently assisted the Ontario Waste Management Corporation develop a procedure for identifying and ranking non-monetary factors for technology selection.

Ms. Deese is author or co-author of several articles and papers addressing environmental issues. She is on the Literature Review and Residuals Management Committees of the Water Pollution Control Federation and is on the Industrial Waste Committee of the New England Water Pollution Control Association. She is an active member of a number of other professional societies.

## E. THOMAS HOUSTON

Tom Houston is responsible for co-ordination of ADL's energy consulting activities in Canada. He has worked in the field of energy economics since 1973, in Canada, France, Algeria and the United Kingdom.

Mr. Houston first gained experience in energy planning and project analysis in Canada. This experience included:

- Feasibility studies of long-distance oil and gas pipeline systems from the Canadian North, oilsand mining and in situ projects and heavy oil upgrading facilities.
- Analysis of land-lease regulations, and fiscal terms governing exploration and development in Canada.
- Determination of potential for displacement of oil by natural gas in Canadian energy markets.

From 1977 to 1980, Mr. Houston worked for the International Energy Agency in Paris, France where he headed the Division for Accelerated Development of Alternative Energy Sources. Additional tasks included:

- Directing the IEA Natural Gas Study.
- Secretariat Co-ordinator for the IEA's Coal Industry Advisory Board.

With ADL, Mr. Houston has worked in the Algiers, and London offices where he has led or participated in several studies related to coal and natural gas with a concentration on marketing, pricing and transportation issues. Since his return to Canada, he has concentrated on US gas market and supply issues, offshore Eastcoast development opportunities and E & P strategic issues.

Mr. Houston studied economics and accounting at Carleton University, 1962-65; and Queen's University, 1966-69. Prior to 1973, he worked for the Parliament of Canada (1969), the Royal Commission on Prices and Incomes (1969-71), and the Department of Finance, International Finance Division (1971-73).

## ROBERT B. POJASEK

## MANAGER, HAZARDOUS MATERIALS GROUP

Robert B. Pojasek, Manager of MAIN's Hazardous Materials Group, has more than 15 years of national and international experience in all phases of chemical use. He has spoken at more than 100 conferences and public forums and has published 50 articles and five books on chemicals management and hazardous waste issues. Dr. Pojasek serves on numerous industrial and governmental review boards and has advised the White House Office of Science and Technology Policy, National Academy of Sciences, World Health Organization, U.S. Environmental Protection Agency, and the U.S. Air Force Scientific Advisory Board.

Dr. Pojasek's experience spans the entire chemical use cycle including: laboratory set-up and management; forecasting industrial chemical use, pro duction, and waste; waste reduction opportunity studies; right-to-know studies; technology evaluations for solid and aqueous waste treatment; transportation and storage evaluations; prevention and contingency planning; safety and emergency medical plans; sampling and analysis protocols; emergency response to spills; surface and groundwater drinking water degredation studies; and hazardous waste site investigations and remedial actions. His experience includes project management of 15 Superfund Sites for immediate remedial actions under EPA contract.

Recent Work:

- Managing remedial investigation, health assessment, remedial design options, community relations for 2-acre landfill with 12,000 buried drums.
- Project management of an engineering feasibility study on groundwater contamination at the facility and remedial engineering for an off-site, 15-acre landfill utilized for industrial waste disposal.
- Design and consulting services for a proposed solvent reclamation facility in a formalized hazardous waste facility siting process.
- Decontamination of PCB-contaminated tooling as part of building demolition project conducted by MAIN contractors.
- Subcontractor on an EPA research project to develop a waste solidification technique which can be used for organically-contaminated soils and sediments at Superfund sites.
- Provided remedial investigation of an on-site disposal area used to dispose of plant wastes.
- Provided right-to-know compliance support, including an inventory of chemical use, review of materials safety data sheets, and a recommendation of a program for instituting proper labeling and employee training.

## EDUCATION

Bachelor of Science in Chemistry, Rutgers University;
Doctor of Philosophy in Chemistry, University of Massachusetts

## TERRY W. ROTHERMEL

A senior staff member at Arthur D. Little, Inc., Dr. Rothermel has concentrated on work related to public policy issues in environmental and resource management, market and technology planning models, and commercial strategies in the pollution control business. In over fifteen years at Arthur D. Little, some of Dr. Rothermel's work has included:

### Environmental Policy and Regulation

- Analyses for the U. S. Environmental Protection Agency (in 1972 and 1978) of the economic effects of environmental regulations on the pollution control industry in the United States.
- A similar examination for the Dutch Government (1982) of the opportunities and problems associated with environmental regulation in the Netherlands.
- Development of testimony on the cost impact of new regulations: 1) on hazardous air pollutant standards for a chemical industry association, and 2) on noise pollution standards for the U. S. Chamber of Commerce.
- Analyses of cost impact and regulatory dynamics in Arthur D. Little's study for the American Iron and Steel Institute of the impact of pollution control requirements upon the U. S. iron and steel industy.

### Public Policy and Regulation - General

- Assessments of cost-benefit potentials of federal R&D programs in support of enhanced oil recovery, advanced power cycle, and desalting technologies for the Department of Energy Administration and the Department of the Interior.

Dr. Rothermel received his B.E. and B.S. degrees in chemical engineering and industrial administration from Yale University and his S.M. and Ph.D. degrees in marketing from the Alfred P. Sloan School of Management at the Massachusetts Institute of Technology.

He is a member of the Air Pollution Control Association, the National Water Supply Improvement Association, the American Marketing Association, and the American Institute of Chemical Engineers. He has authored testimony and delivered papers on environmental regulation, planning models, and pollution control markets. He has published articles in Environmental Science and Technology, Technology Review, and the Harvard Business Review. He is also practicing his public policy skills as a town Selectman in Concord, Massachusetts.

## WILLIAM M. SLOAN

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**EDUCATION**

1959 - Bachelor of Civil Engineering, Cooperative Plan, Georgia Institute of Technology

1965 - Master of Science in Sanitary Engineering, Georgia Institute of Technology

**PROFESSIONAL EXPERIENCE**

1981 to Present — Secretary to the Board, Maryland Hazardous Waste Facilities Siting Board

Executive for independent Board with authority to approve the location of new hazardous waste facilities based on the State's needs and suitability of the location for the facility. Responsibilities include:

Evaluating, by staff and consultants, facility applications received by the Board.

Conducting periodic reviews of the State's hazardous waste treatment and disposal needs, considering generation, availability of management services inside and outside Maryland, and trends in generation and services.

Planning and carrying out studies and exercises to maintain the Board's readiness and expertise.

Conducting activities to maintain a level of awareness by citizens, government, and commerce that will permit informed response to an application, to determinations of treatment and disposal needs, or to other Board actions.

Conducting comparable activities for low-level radioactive waste, which the Act says shall be treated separately, at a lower level.

Administering the office and organizational requirements of the Board.

1984 - 1985 — Chairman, Consortium of State Hazardous Waste Siting Authorities, Inc.; now Secretary and Director

Carried out executive, promotional, and technical tasks in the formative period of the Consortium. Continue to edit and publish **SOLUTIONS**, the Consortium's newsletter.

"Research on Hazardous Waste Management in Maryland; An Exploration of Content, Approach and Applicability," December 1983, Proceedings of a Symposium at the Aspen-Wye Institute, October 1983 (Editor, with Robert H. Roy and Kirkman O'Neal).

"Approach to Technical Assistance for Industrial and Hazardous Waste Generators," September 1983, Board report, with Gary Hunt and Richard W. Walters.

"Hazardous Waste Treatment and Disposal Needs for Maryland," April 1983, Board report.

"First International Symposium on European Hazardous Waste Facilities and the Post-Symposium Facilities Tour," December 1982, Board report.

"New Capacity for Hazardous Waste Disposal: Problems in Making It Happen; What is Being Done," November 1981, with Alan Magan, American Institute of Chemical Engineers Annual Meeting, New Orleans.

"The Case for Government Management of Hazardous Waste," May 1981, debate paper, American Society of Civil Engineer Annual Meeting, New York.

"State Programs for Siting New Hazardous Waste Facilities," August 1981, Hazardous Materials Control Research Institute, Seminar on Hazardous Waste Disposal, Baltimore, Maryland.

"Water Quality Management Plan for Patapsco River (Baltimore Harbor) and Back River Basins," July 1974.

**Professional Affiliations**

American Society of Civil Engineers
Water Pollution Control Federation
National Association of Environmental Professionals

**Honors**

Chi Epsilon
Sigma Xi

**Personal**

Married to Anne Elizabeth Cochran; three children
Born: November 30, 1935

| | |
|---|---|
| 1979 - 1981 | Manager, Hazardous Waste Facilities Program, Maryland Environmental Service<br>Responsible for hazardous waste facilities planning. Coordinated and wrote the interagency draft of the bill that created the Siting Board and other management program elements. |
| 1975 - 1979 | Technical Services Engineer, Maryland Environmental Service<br>Conducted engineering and economic studies of water and wastewater systems for acquisition, facilities plans, and other purposes. |
| 1972 - 1975 | Director, River Basin Planning, Maryland Environmental Service<br>Supervised water quality planning until transfer of the planning function out of the Service; set up citizens advisory councils for river basins of the State. |
| 1969 - 1972 | Director, Baltimore Harbor Water Quality Management Planning, Water Resources Administration and Maryland Environmental Service<br>Obtained data, supervised work, and wrote report. |
| 1965 - 1969 | Engineer, Chesapeake Field Office, Federal Water Pollution Control Administration<br>Conducted water quality and mine drainage studies for predecessor agency of EPA. |
| 1953 - 1965 | Graduate student and research assistant, Georgia Tech Research Institute; U.S. Army Corps of Engineers, bridge-company platoon leader; undergraduate student and cooperative-plan engineering trainee, primarily in stream-flow hydrology. |

## PUBLICATIONS

Editor and principal writer, Waste Management in Maryland **NEWS**, Hazardous Waste Facilities Siting Board, bimonthly since August 1982.

Editor, **SOLUTIONS** Newsletter, Consortium of State Hazardous Waste Siting Authorities, Inc., quarterly, commenced August 1984.

"Economic Exchange of Chemical and Industrial Waste," July 1984. Presented at Recycling Opportunities and Constraints, July 17-19, 1984, Federation of Materials Societies. To be published in Conservation and Recycling, Pergamon Press, Ltd., Great Britain, Summer or Fall, 1985.

"Approval of New Hazardous Waste Facilities," June 1984. Presented at "HAZMAT 1984" conference and exposition, Philadelphia, Pennsylvania.

# APPENDIX B

# BACKGROUND DOCUMENTS ON RISK, IMPACT AND COST CRITERIA

TABLE B1 - PRELIMINARY RANKING OF RISK FACTORS FOR FACILITIES

| FACTOR | LEVEL | REASONS FOR RANKING AND COMMENTS |
|---|---|---|
| • transportation spills - province-wide access system | 5 | • margin of safety much less than one; largely reversible effects; severity of effects dependent on nature and type of spill and proximity and sensitivity of individuals involved<br>• all OWMC commodities - 2.1 to 2.9 spills per year; OWMC special wastes - 1.5 to 2.2 spills per year; but most hazardous spills 1 in 125 to 1 in 4000 years; even smaller probability of spills at locations where potential for human exposure<br>• mitigation cannot be assumed<br>• mitigation of spill possible through fast response and clean-up<br>• potential for evacuation in extreme cases<br>• detection after the event only<br>• with Province-wide access system looking at total potential spill risks across system (includes spill data on local and regional access system)<br>• numbers fail to reflect differences between local and regional access systems and province-wide access system (e.g. with province-wide access routes much of transport on 400 series highways and waste traffic dispersed across a range of routes) |
| • transportation spills - local and regional access system | 5 | • only a small proportion of potential spill risks for total provincial system; all OWMC commodities - 0.11 to 0.99 spills per year; OWMC special wastes 0.04 to 0.25 spills per year; but most hazardous spills 1 in 125 to 1 in 4000 years; even smaller probability of spills at locations where potential for human exposure<br>• included within province-wide data<br>• in contrast to much of the balance of the province-wide system:<br>- OWMC traffic tends to be a higher proportion of total road traffic<br>- function of roads less consistent with haulage of untreated wastes<br>- people and sensitive uses such as schools |

TABLE B1 - PRELIMINARY RANKING OF RISK FACTORS FOR FACILITIES (continued)

| FACTOR | LEVEL | REASONS FOR RANKING AND COMMENTS |
|---|---|---|
| transportation spills - local and regions access system (Cont'd) | | tend to be closer to the roads<br>• ≪ margin of safety much less than one; largely reversible effects; severity of effects dependent as nature and type of spill and proximity and sensitivity of individuals involved<br>• mitigation cannot be assumed<br>• mitigation of spill possible through fast response and clean-up<br>• potential for evacuation in extreme cases<br>• detection after the fact only |
| • transportation accidents - province-wide access system | 5 | • severity - injury to death 1.82 to 2.83 accidents per year across entire transportation system; 1% of accidents cause fatalities<br>• mitigation cannot be assumed<br>• potential for severe accidents can be reduced by vehicle design and road design and through transportation operating procedures; road improvement limited to local and regional access system |
| • stack and fugitive emissions - direct inhalation | 5 | • risks levels acceptable - $10^{-6}$ lifetime risk of cancer at point of maximum concentration for stack<br>• $10^{-6}$ lifetime risk of cancer at boundary of buffer zone for fugitive emissions<br>• because of conservative assumptions actual risk levels would be much lower<br>• limited opportunity for detection and mitigation |
| • natural containment - site | 5 | • degree of hazard of materials minimized by treatment and solidification and through design and operations and landfill<br>• actual range of leachate quality will not be known until some time after facility is in operation<br>• literature review of data on leaching tests on solidified wastes suggests leachate would not be considered highly toxic but |

TABLE B1 - PRELIMINARY RANKING OF RISK FACTORS FOR FACILITIES (continued)

| FACTOR | LEVEL | REASONS FOR RANKING AND COMMENTS |
|---|---|---|
| • natural containment - site (Cont'd) | 5 | treatment might be required prior to off-site discharge<br>• assumed that leachate not highly toxic but may not meet all Ontario drinking water objectives; degree of hazard will be further reduced through attenuation properties of silt-clay soils<br>• in the case of the incinerator/physical chemical treatment plant potential for release can be minimized through design and operating procedures; further attenuation would be provided by silt-clay soils<br>• will vary depending on degree of natural containment provided by site<br>• possible to take remedial actions during operations and initial post-closure period; not possible to assure long-term mitigation with landfill |
| • transportation explosion | 4 | • potentially severe for individuals in immediate proximity of event; margin of safety well within one<br>• likelihood of spills or accidents expected to be quite remote (see transportation spills and accidents)<br>• very small proportion of materials hauled has explosive potential; potential for explosion rare in the extreme<br>• statistically not expected to occur during operating life of facility; even smaller proportion of events would occur at a location where health effects may occur, (e.g. adjacent to hours)<br>• mitigation cannot be assumed |
| • short term upset events - fire | 4 | • potentially severe for individuals in immediate proximity of event; margin of safety well within one<br>• likelihood of fire expected to be extremely remote - not expected to occur during operating life of facility; likelihood of events which would prove a risk to the health of area residents would be even more remote |

TABLE B1 - PRELIMINARY RANKING OF RISK FACTORS FOR FACILITIES (continued)

| FACTOR | LEVEL | REASONS FOR RANKING AND COMMENTS |
|---|---|---|
| • short term upset events - fire (Cont'd) | 4 | • mitigation cannot be assumed; effects may be limited by fast response and contingency plans (e.g. evacuation)<br>• effects may occur before remedial action possible |
| • surface water transportation impact on surface water quality | 3 | • potentially severe if release of untreated wastes into watercourse and direct human consumption<br>• frequency of event would be extremely remote; i.e. likelihood of spill remote; likelihood of spill into a watercourse more remote; likelihood of a spill where human consumption occurs even more remote; likelihood of sufficient human consumption to represent a risk to health still more remote<br>• mitigation potential - may be possible to notify users prior to consumption; can monitor water quality until no longer a problem; can provide alternative water supplies in the interim<br>• dilution potential of watercourses |
| • surface water use - site | 3 | • potentially severe if release of untreated waste into watercourse and direct human consumption<br>• release as a result of flooding mitigatible<br>• release as a result of a leak or spill (incinerator/physical chemical treatment plant) largely mitigatible through design and operations; likelihood of a leak or spill of a concentration which would represent a risk to health very remote<br>• with short term event - mitigation potential - may be possible to notify users prior to consumption; can monitor water quality until no longer a problem; can provide alternative water supplies in the interim<br>• lateral migration to surface water uses by means of fracture zone - a potential concern |

TABLE B1 - PRELIMINARY RANKING OF RISK FACTORS FOR FACILITIES (continued)

| FACTOR | LEVEL | REASONS FOR RANKING AND COMMENTS |
|---|---|---|
| surface water use - site (Cont'd) | | • long term potential for leachate migration - ground - surface water connection - surface water use a secondary consideration - primary consideration - natural containment as any use represents a potential concern<br>• dilution potential of watercourses |
| • groundwater use - site | 3 | • secondary consideration to natural containment; any use of groundwater a concern if no or inadequate natural containment<br>• with limited or no use of groundwater possible to provide alternative sources of water and to use dilution as a further means of reducing concentration<br>• mitigation potential; monitoring and provision of alternative water supply if concern identified; can not assume restriction of groundwater over period during which leachate mitigation possible<br>• mitigation more difficult with extensive use of groundwater and/or alternative supply of water not available |
| • short term upset events - scrubber failure | 3 | • margin of safety, i.e. discernible effect with worst case event, slightly less than one at maximum point of impingement<br>• potential health effects mild and reversible<br>• scrubber failure relatively frequent compared to fatal transportation accidents<br>• proportion of scrubber failure where possible health effects very small; difficult to predict with accuracy<br>• events not mitigatible<br>• no basis for distinguishing (in ranking terms) between relatively frequent, non-mitigatible events with mild reversible effects (scrubber failure) and potentially severe, very rare and potentially mitigatible events (surface water spills) |

TABLE B1 - PRELIMINARY RANKING OF RISK FACTORS FOR FACILITIES (continued)

| FACTOR | LEVEL | REASONS FOR RANKING AND COMMENTS |
|---|---|---|
| • stack and fugitive emissions - crops and livestock | 2 | • predicted severity of risk - negligible:<br>- $10^{-7}$ (1) - stack emissions - livestock<br>- $10^{-7}$ - stack emissions - crops<br>- $10^{-10}$ - fugitive emissions - livestock<br>- $10^{-8}$ - fugitive emissions - crops<br>• indirect pathways - possible (although difficult) to monitor contaminant levels and to take remedial actions prior to long-term risk to human health |
| • stack and fugitive emissions - cisterns and ponds | 2 | • predicted severity of risk - negligible:<br>- $10^{-7}$ - stack emissions - cisterns and ponds<br>- $10^{-9}$ - fugitive emissions - cisterns and ponds<br>• indirect pathways - possible (although difficult) to monitor contaminant levels and to take remedial actions prior to long-term risk to human health |
| • surface water at site - flooding potential | 1 | • potentially severe if release of untreated wastes into watercourse and direct human consumption<br>• severity and frequency completely mitigatible<br>• possible to design and operate facility in a manner which would avoid a surface water release<br>• even if release does occur, possible to notify surface water users prior to human consumption |

[1] $10^{-7}$ - one chance in ten million of an individual contracting cancer assuming maximum (continuous) exposure to the highest levels of contaminants for a lifetime

Source: OWMC Site Selection Criteria

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site | Residents and Land Use Impacts | Displacement Residents (also Number of Residences - Existing Land Uses) | 5 | • potentially serious impacts on individuals involved<br>• direct severe impacts<br>• the psychological and in some instances economic, effects impacts of displacement and relocation can affect people for many years<br>• although compensation provided may not offset all impacts |
| | | Rare Species | 5 | • potentially serious impacts on highly significant resource<br>• province-wide policy and public concern<br>• may not be possible to mitigate<br>• permanent resource loss |
| Site Vicinity | Residents and Land Use Impacts | Disruption of Residents - Adjacent (also Number of Residences - Existing Land Use) | 5 | • potentially serious impacts<br>• direct and long-term impacts<br>• range of potential impacts, e.g., noise, visual, property values<br>• impacts may not be fully mitigatible |
| | Agricultural Resources | Disruption of Farm Operations - Adjacent | 5 | • potentially serious impacts for individual operations as a result of noise, traffic and property value changes<br>• direct and long-term impacts; individuals affected in their day-to-day activities for the life of the facility<br>• range of potential impacts<br>• impacts may not be fully mitigatible; may not be possible to, for example, fully attenuate noise or to prevent such effects as visual intrusion, community character and traffic changes |
| | | Partial Displacement of Farms | 5 | • direct impacts on individuals affected; may be long-term; range of potential effects, some of which may be unanticipated |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site | Agricultural Resources | Displacement of Farms | 4 | • potentially mitigatible if compensated and successfully relocated in same or comparable area<br>• potentially serious and long-term impacts on individuals if compensation not complete<br>• impacts would tend to be greater with family farm businesses<br>• affects other agricultural, land use, social and economic factors |
| | | Loss of Farm Land | 4 | • permanent loss of provincially and regionally significant resource<br>• limited amount of land displaced<br>• capability and use not as high as areas rejected during previous site selection stages |
| | Natural Environment | Potential for Occurrence of Significant Biological Features | 4 | • potential for highly significant resources<br>• potential would be largely clarified through additional field work<br>• effects may not be mitigatible |
| | Land Use | Planned and Proposed Land Use (includes Planned and Proposed Agricultural Land Uses _ Agricultural) | 4 | • important policy concern for municipality<br>• planned land use basis for public and private decision-making<br>• planned and proposed uses a direct reflection of community expectations for area<br>• indirect impact; dependent on actions of planning staff and development interests - can alter impacts by altering planning<br>• potential for mitigation through joint land use planning and control<br>• a change in land use policies or proposals can have a range of other land use, social and economic repercussions |
| Site Vicinity | Air Resources | Existing and Anticipated Air Quality | 4 | • moderate concern, within criteria (except particulates) at all sites<br>• could affect facility operations |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site Vicinity | Air Resources | Existing and Anticipated Air Quality | 4 | • important role in perceived risk<br>• closely linked to social, economic and agricultural factors<br>• mitigation of existing sources outside control of OWMC |
|  | Residents | Disruption of Residents - Non-Adjacent | 4 | • minor to moderate levels of impacts anticipated<br>• range of possible impacts<br>• long duration<br>• potentially affects a broad geographic area and large number of people<br>• impacts may be magnified by perceptions<br>• potential for amelioration through facility design and operational changes<br>• potential for addressing perceived impacts through community consultation<br>• although impacts expected to be moderate potential for more serious impacts than anticipated because of role of perception |
|  | Residents and Land Use Impacts | Economic Stability of the Residents | 4 | • potential impacts, both actual and perceived, may diminish over time; if actual impacts less than community expectations, property values may return to former levels<br>• perceptions of impact may remain strong over life of the facility<br>• indirect impacts; property value changes partly dependent on perceptions and partly dependent on other impacts; if other impacts don't occur property values may not change<br>• significant community concern<br>• degree of disruption dependent on individual decisions of owners and potential purchasers as well as their location in relation to the facility<br>• potential effects could extend over a wide area and could affect a large number of properties |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site Vicinity | Residents and Land Use Impacts | Economic Stability of the Residents | 4 | • connections to a wide range of other factors such as agricultural operations, economic base and future land use<br>• potential for mitigation through such measures as property value guarantees<br>• impacts expected to be moderate and temporary; potential for more serious impacts than anticipated because of the role of perception in what people are willing to pay for property |
| | Businesses | Business Activities (sensitive) e.g. tourism, food processing | 4 | • various levels of impacts anticipated<br>• however, potential for more severe impacts because of impacts on processes, traffic impacts, connections to community image<br>• potential for mitigation by alternating OWMC facility design or operations through the provision of measures at site, e.g. alternative access points<br>• indirect impacts, both actual and perceived<br>• tourism and leisure related business in site vicinity a small component of tourist economy<br>• degree of disruption dependent on voluntary decisions of users and operators<br>• perception of consumers and customers can play an important role in determining impacts |
| | Community Features and Services | Disruption of Community and Recreation Features (sensitive) | 4 | • moderate levels of impacts anticipated<br>• potential for mitigation by altering OWMC facility design or operations or through the provision of measures at community and recreation feature, e.g. vegetation<br>• indirect impacts<br>• component of perception<br>• degree of disruption dependent on voluntary decisions of users and operators although impacts expected to be relatively moderate, potential for more |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site Vicinity | Community Features and Services | Disruption of Community and Recreation Features (sensitive) | 4 | impacts than anticipated because of role of perception<br>• need to consider on a feature-by-feature basis<br>• potential for mitigation through the provision of alternative facilities |
| | Land Use | Planned and Proposed Land Use (includes Planned and Proposed Agricultural Land Uses - Agricultural | 4 | • important policy concern<br>• planned land use basis for public and private decision-making<br>• planned and proposed land uses a direct reflection of community expectations for area<br>• indirect impact<br>• potential for mitigation through joint land use planning and control<br>• affects a range of other land use, social and economic factors |
| | Agricultural Resources | Disruption of Farm Operations - Non-adjacent | 4 | • indirect impacts; day-to-day operations not expected to be directly affected but might be affected indirectly by other impacts such as property value changes and effects on community character and image<br>• minor to moderate levels of impacts anticipated<br>• long duration and potentially affects a broad geographic area and a large number of people<br>• impacts may be increased by perceptions<br>• major community concern<br>• potential for amelioration through facility design and operational changes<br>• potential for addressing perceived impacts through community consultation<br>• although impacts expected to be moderate potential for more serious impacts than anticipated because of role of perception in the determination of social and economic impacts |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Community and Regional | Community and Regional | Social Stability | 4 | • indirect impacts; direct effects, such as traffic, noise, visual intrusion; social stability changes a consequence of peoples' actions, e.g. moving out as a result of direct or perceived effects<br>• largely perceived impacts; if actual magnitude of direct effects quite minor, social stability can still be relatively great because of role of perception in influencing peoples' actions<br>• important area of community concern; raised in public meetings and briefs<br>• potentially affects a wide area and a large number of people<br>• connections to a wide range of other factors<br>• degree of disruption dependent on voluntary decisions of individuals and businesses; e.g to expand or close down business, or move out of community<br>• relatively small number of jobs and local sales (as compared with major employers) and proximity of sites to urban centres (for worker residences) disrupting to the local community will be quite limited<br>• although impacts expected to be relatively minor to moderate; potential for more serious impacts than anticipated because of role of perception |
| | | Social Cohesion | 4 | • indirect impacts; social cohesion not directly impacted but may be influenced by other impacts or perceived impacts<br>• largely perceived impacts; size and nature of facility operations not such that major effects on social cohesion should reasonably occur<br>• important area of community concern; concern raised in many briefs and submissions<br>• potentially affects a wide area and a large number of people<br>• degree of disruption dependent on voluntary decisions of individuals and businesses regarding changes in patterns of social and economic interaction in response to facility's presence |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Community and Regional | Community and Regional | Social Cohesion | 4 | • relatively small number of jobs and local sales (as compared with major employers) and proximity of sites to urban centres (for worker residences); disruption to the local community will be quite limited<br>• although impacts expected to be relatively minor to moderate; potential for more serious impacts than anticipated because of role of perception |
| | | Community Character | 4 | • indirect impacts; community character need not be directly affected by facility; consequences of current image of community, nature of facility and associated impacts and perceptions regarding how area changed with facility in place<br>• potentially affects a wide area and a large number of people<br>• degree of disruption dependent on voluntary decisions of individuals and businesses; if facility viewed as major conflict with character of area, may influence actions of individuals and businesses<br>• relatively small number of jobs and local sales (as compared with major employers) and proximity of sites to urban centres (for worker residences); disruption to the local community should be quite limited<br>• although impacts expected to be relatively minor to moderate; potential for more severe impacts than anticipated because of role of perception |
| | | Economic Base | 4 | • some minor to moderate local benefits as a result of local employment and the income it generates<br>• direct and indirect and positive and negative impacts are possible as a result of such changes as individual business impacts and potential property value changes<br>• some perceived impacts; investment and business operations decisions, in part, a consequence of, for example, changes in community character<br>• important area of community concern; as identified in public meetings and submissions |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Community and Regional | Community and Regional | Economic Base | 4 | • affects a wide range of other factors; if the economic base of an area is affected, there are likely to be social, municipal service and finance, and land use<br>• potentially affects a wide area and a large number of people<br>• degree of disruption dependent on voluntary decisions of individuals and businesses although actual impacts expected to be relatively minor to moderate based on facility characteristics and potential effects; direct effects on local businesses and indirect effects on economy should be limited<br>• potential to decrease negative impacts if facility operated as an attraction in itself, or through economic incentives to development, if appropriate |
|  | Agricultural Resources | Stability of Farm Population | 4 | • potential for serious unanticipated impacts, if, for example, considerable out-migration occurs based on perceived effects<br>• important area of community concern<br>• potentially affects a wide area and a large number of people<br>• connections to a wide range of other factors; change in stability of farm population could have a range land use, social and economic repercussions<br>• degree of disruption dependent on voluntary decisions of individuals and businesses<br>• relatively small number of jobs and local sales (as compared with major employers) and proximity of sites to urban centres (for worker homes); disruption to the local agricultural community is expected to be quite limited<br>• although impacts expected to be relatively minor to moderate, potential for more severe impacts than anticipated because of role of perception |
| Access Roads | Residents and Land Use Impacts | Disruption of Residents - Adjacent | 4 | • impacts in terms of increased noise levels and potential constraints to property access<br>• impacts generally moderate on regional access road system as OWMC traffic generally a small proportion of total volumes projects for routes |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Access Roads | Agricultural Resources | Disruption of Farm Traffic and Livestock Crossings | 4 | • potential interference with farm vehicle movements and cattle crossings (on local roads)<br>• mitigation of accident risk less necessary on regional roads and difficult to achieve on local roads<br>• can mitigate cattle crossings<br>• potentially disruptive to farm operations<br>• impacts generally moderate on regional access road system as OWMC traffic in most cases represents a small proportion of total volumes projected for routes<br>• impacts expected to be greater on local access roads<br>• long duration impacts<br>• potentially affects a large number of people |
| Site | Businesses and Land Use Impacts | Displacement of Businesses (also Number of Commercial and Industrial Facilities - Land Use) | 3 | • largely mitigatible impacts<br>• short-term impacts provided displaced uses relocated with appropriate compensation<br>• wide variations in terms of employment and sales<br>• potential of retention of uses on some sites |
| | Land Use | Land Use Stability | 3 | • indirect impacts<br>• ancillary or secondary factor; should be used to temper other land use, economic, social and agricultural factors rather than as representing major concern by itself<br>• does not represent a direct conflict with a given agency policy<br>• data of limited reliability for use in decision-making |
| Site Vicinity | Land Use | Land Use Stability | 3 | • indirect impacts<br>• ancillary or secondary factor; should be used to temper other land use, economic, social and agricultural factors rather than as representing major concern by itself |

TABLE B2 - PRELIMINARY RANKING OF IMPACT RACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site Vicinity | Land Use | Land Use Stability | 3 | • does not represent a direct conflict with a given policy |
| | | | | • data of limited reliability for use in decision-making |
| Community and Regional | Agricultural Resources | Stability of Agricultural Base | 3 | • potential for serious unanticipated impacts |
| | | | | • important area of community concern; identified through public meetings and submissions |
| | | | | • potentially affects a wide area and a large number of people |
| | | | | • connections to a wide range of other factors; changes in agricultural base could have economic base, land use, social and municipal service and finance implications |
| | | | | • degree of disruption dependent on voluntary decisions of individuals and businesses; consequences of combined effects of a large number of individual decisions which may be governed as much by perceptions as by directly predictable effects |
| | | | | • relatively small number of jobs and local sales (as compared with major employers) and proximity of sites to urban centres (for worker homes); disruption to the local agricultural community is expected to be quite limited |
| | | | | • although impacts expected to be relatively minor to moderate, potential for more severe impacts than anticipated because of role of perception |
| | | Disruption of Farm Economy (regional) | 3 | • uncertainty about effects from emissions on crops and livestock which govern agricultural economy |
| | | | | • connection to many other factors; changes in farm economy could have many social, land use and economic repercussions |
| | | | | • wide area potentially affected |
| | | | | • mitigation potential could reduce significance of this factor; by addressing specific concerns of individual operations may be possible to reduce overall effects on farm economy |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Access Roads | Community Features and Services | Disruption-Community and Recreation Features (sensitive - e.g. schools) | 3 | • impacts in the form of constraints to pedestrian and vehicular access as a result of increased traffic and noise level changes<br>• OWMC traffic in most cases a small proportion of total traffic<br>• potential for mitigation, e.g. crosswalks, underpasses, alternative access points, noise attenuation if significant concern identified |
| | | Planned and Proposed Land Uses | 3 | • potentially significant uses such as major residential development proposals<br>• a major change inland use which proceeds or fails to proceed can affect a range of other land use, social and economic factors<br>• potential policy conflict with local or regional official plans<br>• OWMC traffic in some instances a small proportion of total traffic<br>• future land use along regional access system likely to be subject to reverse frontages, setback, access restrictions, etc. which likely to limit conflict<br>• potential for additional measures, e.g., noise attenuation, access changes if significant concern identified |
| Site | Community Features and Services | Displacement of Community, Recreation and Historic Features | 2 | • no major community features such as community centres or schools on candidate sites<br>• degree of displacement of such features minimal<br>• effects short-term and mitigatible<br>• qualitative interpretation and dependent on voluntary decisions by users<br>• assumes commitment to mitigate displacement of historic features |
| | Natural Environment | Natural Vegetation Displaced | 2 | • effects expected to be relatively minor<br>• direct impacts - permanent resource loss<br>• relatively insignificant resources |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site | Natural Environment | Natural Vegetation Displaced | 2 | • potentially mitigatible<br>• no agency policy commitment |
| Site Vicinity | Businesses | Operation of Business Activities (non-sensitive) | 2 | • pertains to commercial, home, agri-businesses and industrial activities, e.g., gas stations not expected to be negatively affected by facility operations<br>• no detrimental or negative impacts are expected; positive direct and indirect effects are possible<br>• moderate levels of impacts anticipated<br>• potentially mitigatible on an activity-by activity basis if concerns identified |
| | Land Use | Existing Land Use - Land Use Pattern | 2 | • plays an overview role supplementary to other factors<br>• imprecise measure of impacts; will assume minor role in decision-making<br>• no policy conflict |
| | Natural Environment | Significant Environmental Units | 2 | • no to minor indirect impacts anticipated because of facility characteristics, anticipated impacts and proximity of SEUs<br>• provincially and regionally significant resource from a policy perspective |
| Community and Regional | Community and Regional | Municipal Service and Financial Impacts | 2 | • OWMC commitment that no municipality will suffer financially<br>• most siting configurations expected to represent net benefit to local taxpayers by broadening assessment base |
| | Land Use | Existing Land Use | 2 | • indirect impacts; uses beyond 2 km not expected to be directly affected<br>• impacts expected to be less than for other study areas<br>• supplementary role to other social, economic and land use factors; provides overview of relationship of use to broad pattern of land use in community and region |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Community and Regional | Land Use | Existing Land Use | 2 | • possible area of concern if impacts can be demonstrated on uses just beyond site vicinity; imprecise measure - will not assume a major role in decision-making |
| | | Planned and Proposed Land Uses | 2 | • indirect impacts; planned and proposed land uses more than 2 km from facility not likely to be directly affected; indirect effects if, for example, influences investment, decisions of developers, builders or potential home or businesses owners<br>• impacts likely to be less than for other study areas<br>• potentially mitigatible through planning or policy change if concern identified |
| | | | 2 | • possible area of concern if impacts can be demonstrated on future uses just beyond site vicinity |
| Access Roads | Residents and Land Use Impacts | Disruption of Residents - Non Adjacent | 2 | • potential for some accessibility/nuisance effects, e.g. property access, noise<br>• largely perceived impacts as primary effects, such as noise largely limited to adjacent properties<br>• minor levels of impact anticipated<br>• OWMC traffic on most roads a small proportion of total traffic<br>• residences not likely to be affected by noise level changes based on projected noise levels |
| | Business and Land Use Impacts | Disruption of Business Activities | 2 | • commercial and industrial uses not expected to be sensitive to traffic and noise impacts<br>• beneficial to some commercial uses, e.g. increased business from OWMC related traffic<br>• if concern identified, potential for mitigation on a use-by use basis<br>• degree of disruption dependent on voluntary decisions of operators and customers |
| | Agricultural Resources | Disruption of Crop and Livestock Production | 2 | • indirect minor impacts to farm operators; small area affected |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Access Roads | Agricultural Resources | Disruption of Crop and Livestock Production | 2 | • frequency of occurrence very low and size of affected area small<br>• opportunities exist for mitigation and compensation; spill can be cleaned up and crop area affected removed, compensation can be paid |
| | Natural Environment | Fish Communities | 2 | • likelihood of spill into watercourse such that fish mortality occurs is extremely remote<br>• potential direct impact - fish mortality<br>• zone of impact may be local<br>• potential for remedial actions; bridges can, for example, be modified to reduce the potential for spills escaping directly into certain watercourses<br>• need and types of mitigation would have to be assessed on a crossing-by-crossing basis |
| Site | Community and Regional | Heritage Features | - | • relatively insignificant resources on all sites<br>• assumes resources will be mitigated |
| | | Archaeological Resources | 1 | • commitment to avoid or excavate archaeological resources on any site(s) prior to site development |
| Site Vicinity | Air Resources | Restraints to Dispersion | 1 | • minimal restraints to dispersion for all sites; major restraints to dispersion, e.g. Niagara Escarpment addressed during previous site selection stages<br>• if restraints are determined to be more serious than originally anticipated, can be mitigated through design or operations |
| | Community Features and Services | Disruption of Community and Recreation Features (non-sensitive) | 1 | • pertains to community recreational and historical features, e.g. arenas whose operations are not expected to be affected by facility operations<br>• potentially mitigatible on a feature-by-feature basis if concerns identified |
| | Land Use | Provincial Planning Areas | 1 | • sufficiently removed from areas of concern that impacts expected to be negligible to very minor<br>• no direct conflicts with policies apparent |

TABLE B2 - PRELIMINARY RANKING OF IMPACT FACTORS FOR FACILITIES (continued)

| STUDY AREA | FACTOR GROUPING | FACTOR | RANK | COMMENTS |
|---|---|---|---|---|
| Site Vicinity | Land Use | Provincial Planning Areas | 1 | • possible to mitigate areas of concern through agency discussions, design adjustments and land use controls in site vicinity |
| | Natural Environment | Rare Species | 1 | • some significant occurrences but most are already accounted for in SEUs<br>• no to minor indirect impacts anticipated<br>• impacts may be mitigatible |
| | | Significant Fish and Wildlife Features | 1 | • may not be mitigatible<br>• moderate biological significance only<br>• no to minor indirect impacts anticipated<br>• impacts may be mitigatible |
| Community and Regional | Land Use | Provincial Planning Areas | 1 | • sufficiently removed from areas of concern that impacts expected to be negligible to very minor<br>• no direct conflicts with policies apparent<br>• possible to mitigate areas of concern through agency discussions, design adjustments and land use controls in site vicinity |
| Access Roads | Land Use | Existing Land Use-Land Use Pattern | 1 | • impacts expected to be very minor and indirect for all sites<br>• factor plays minor overview role supplementary to other factors<br>• imprecise measure of impacts; should assume minor role in decision-making<br>• no agency policy conflict |

Source: OWMC Site Selection Criteria

## TABLE B3 - COMMUNITY IMPACT

### CONCEPTUAL MAPPING
### MAJOR DIVISIONS

COMMUNITY PLANNING

- Land Use and Development (Existing, future, residential, commercial/industrial, recreational, institutional, agricultural)
- Infrastructure (Utilities, transportation, recreational, medical, safety)

ECONOMICS

- Local Government Finance (Taxes, expenditures, services)
- Private Economy (Employment, competitiveness, household economics, property values)

SOCIAL WELFARE

- Public Health and Safety (Health, environmental risk safety, nuisances)
- Community Social Structure/Interactions (Families, groups, neighborhoods)
- Amenities (Aesthetics, congestion, revered locations, culture)

ENVIRONMENT

- Land (Form, soils, geology, vegetation, wildlife)
- Air (Quality, weather, life)
- Water (Surface, wetlands, ground, quality and quantity, aquatic life)

# COMMUNITY IMPACT FOR CONCEPTUAL MAPPING

November 30, 1984

## I. COMMUNITY PLANNING

A. Land Use and Development (Existing, future, residential, commercial/industrial, recreational, institutional, agricultural)

- 1. Existing Land Uses
    - a. Residential
        - 1) Multi-family
        - 2) Single-family
    - b. Commercial
    - c. Industrial
        - 1) Manufacturing
        - 2) Processing
        - 3) Warehousing
        - 4) Office
    - d. Open Space
        - 1) Parks
        - 2) Beaches
        - 3) Private
    - e. Institutional
        - 1) Schools
        - 2) Universities/Colleges
        - 3) Medical
        - 4) Other
    - f. Agricultural
        - 1) Cropland
        - 2) Grazing Land
        - 3) Forested Land
    - g. Other
- 2. Future Land Uses
    - a. Residential
        - 1) Multi-family
        - 2) Single-family
    - b. Commercial

c. Industrial

    1) Manufacturing
    2) Processing
    3) Warehousing
    4) Office

d. Open Space

    1) Parks
    2) Beaches
    3) Private

e. Institutional

    1) Schools
    2) Universities/Colleges
    3) Medical
    4) Other

f. Agricultural

    1) Cropland
    2) Grazing Land
    3) Forested Land

g. Other

3. Comprehensive Plan

a. Population

    1) Number
    2) Characteristics

b. Zoning

    1) Existing
    2) Future

c. Land Availability

d. Environmental Sensitivity

    1) Flood Plains
    2) Drainage Patterns
    3) Neighborhood Character

B. Infrastructure (Utilities, transportation, recreational, medical, safety)

1. Utilities

a. Water

    1) Supply - Capacity
    2) Treatment Requirements
    3) Distribution System

- b. Sewer - Capacity
- c. Sewage Treatment
    - 1) Plant Capacity
    - 2) Process Compatibility
    - 3) Sludge Quality
- d. Electricity
- e. Gas

2. Transportation
    - a. Highway/Streets
        - 1) Capacity - Number of Vehicles
        - 2) Capacity - Types of Vehicles
    - b. Rail
    - c. Air
        - 1) Flight Paths
        - 2) Visibility
    - d. Water
        - 1) Port Operation
        - 2) Channels
3. Other Facilities
    - a. Recreational
        - 1) Public
        - 2) Private
    - b. Public Safety
        - 1) Police Stations
        - 2) Fire Stations
        - 3) Rescue Stations
    - c. Medical Facilities
        - 1) In-patient
        - 2) Out-patient
    - d. Municipal Solid Waste
        - 1) Collection
        - 2) Disposal

## II. ECONOMICS

- A. Local Government Finance (Taxes, expenditures, service)
  - 1. Revenues
    - a. Property Taxes
      - 1) Tax base
      - 2) Receipts
    - b. Other
      - 1) Income Tax
      - 2) Fees
      - 3) Subsidies
  - 2. Expenditures - Operating
    - a. Roads
    - b. Utilities
      - 1) Water
      - 2) Sewerage
      - 3) Solid Waste
    - c. Services
      - 1) Welfare
      - 2) Fire
      - 3) Police
      - 4) Education
    - d. Administration
      - 1) Planning
      - 2) Data Management
      - 3) Personnel Training
      - 4) Legal Fees
      - 5) Consultants
- B. Private Economy (Employment, competitiveness, household economics, property values)
  - 1. Employment
    - a. Hazardous Waste Facility
      - 1) Proposed Facility
      - 2) Other Firms
    - b. Existing Employment
      - 1) Industrial
      - 2) Commercial
      - 3) Medical

        - 4) Other Professional
        - 5) Tourism
      - c. Future Employment
        - 1) Industrial
        - 2) Commercial
        - 3) Medical
        - 4) Other Professional
        - 5) Tourism
      - d. Local Industry Competitiveness
        - 1) Manufacturing
        - 2) Small Businesses
    - 2. Individual/Household Economy
      - a. Income
      - b. Expenditures
        - 1) Food and Clothing
        - 2) Maintenance
        - 3) Professional Services
        - 4) Taxes
        - 5) Opposition to Facility
        - 6) Housing
        - 7) Other
      - c. Property Values

III. SOCIAL WELFARE

- A. Public Health and Safety (Health, environmental risks, safety, nuisances)
  - 1. Health
    - a. Acute Illnesses
    - b. Chronic Illnesses
      - 1) Physical
      - 2) Anxiety
      - 3) Other Mental
      - 4) Drug use
    - c. Special Populations
      - 1) Elderly
      - 2) Chronically Ill
      - 3) Children
      - 4) Hospitalized
      - 5) Confined

2. Environmental Risks

   a. Drinking Water Quality

      1) Groundwater
      2) Reservoir
      3) Surface Water - Flowing

   b. Food Chain

      1) Aquatic Life
      2) Crops
      3) Other Animals

3. Safety

   a. Traffic

      1) School Bus Routes
      2) Truck Traffic
      3) Other Vehicles
      4) Railroad Crossings

   b. Other Safety Factors

      1) Airplanes

4. Nuisances

   a. Odors

   b. Noise - Ambient

   c. Vector Control

   d. Other

B. Community Social Structure/Interactions (Families, groups, neighborhoods)

1. Community Structure

   a. Individual Components

      1) Families
      2) Elderly
      3) Tourists
      4) Migrants
      5) Political Leadership
      6) Poor People
      7) Minorities
      8) Others

   b. Community Groups

      1) Religious
      2) Neighborhood Associations
      3) Political Parties

        4) Schools
        5) Informal
        6) Social Clubs

    c. Community Relations

        1) Neighborhood Stability
        2) Crime Rate
        3) Group Antagonisms

2. Daily Patterns

    a. Commutation

    b. Recreation

    c. Shopping

    d. Education

3. Intangibles

    a. Equity

        1) Racial
        2) Inter-regional
        3) Economic
        4) Inter-generational
        5) Religious

    b. Quality of Life

        1) Uncertainty of Future
        2) Pace
        3) Community Image
        4) Educational Opportunity

C. Amenities (Aesthetics, congestion, revered locations, culture)

1. Aesthetics

    a. Surface Water

    b. Viewscapes

        1) Urban
        2) Rural

2. Nuisances

    a. Traffic Congestion

    b. Odors

    c. Ambient Noise Level

3. Facilities/Resources

a. Revered Locations

1) Natural Landmarks
2) Historic Sites
3) Archeological Sites

b. Cultural Resources

1) Libraries
2) Museums, Galleries
3) Musical Organizations
4) Theaters

IV. ENVIRONMENT

A. Land (Form, soils, geology, vegetation, wildlife)

1. Geology and Soils

a. Topography

1) Character
2) Development Potential

b. Geology

1) Faults
2) Character
3) Development Potential

c. Soils

1) Cultivatable
2) Drainage
3) Erosion

d. Mineral Resources

1) Existing Use
2) Potentially Usable
3) Previously Extracted

2. Vegetation

a. Cropland

1) Active
2) Fallow

b. Forest

1) Commercial
2) Other

c. Wildlife Habitat

3. Wildlife

a. Population

1) Numbers
2) Species Diversity
3) Endangered Species

b. Health

c. Recreational Value

B. Air (Quality, weather, life)

1. Quality

a. Visible Emissions

1) Attainment Area
2) Non-attainment Area

b. Invisible Gaseous Constituents

1) Attainment Area
2) Non-attainment Area

2. Weather Characteristics

a. Fog

b. Wind

c. Temperature

3. Birds

a. Population

1) Numbers
2) Species

b. Health

C. Water (Surface, wetlands, ground, quality and quantity, aquatic life)

1. Surface Water

a. Quality

1) Biochemical
2) Sediment

b. Drainage Patterns

c. Water Supply Use
  1) Existing
  2) Potential

d. Marshlands
  1) Quantity
  2) Quality
  3) Flora Species

2. Groundwater

a. Flow Patterns
  1) Direction
  2) Discharge Point

b. Quality
  1) Biochemical
  2) Saltwater Intrusion

c. Use
  1) Existing
  2) Potential

3. Aquatic Life

a. Fish and Shellfish
  1) Population
  2) Species Diversity
  3) Health
  4) Recreational Value
  5) Commercial Value

b. Other Aquatic Life
  1) Population
  2) Species Diversity
  3) Health
  4) Food Chain Links

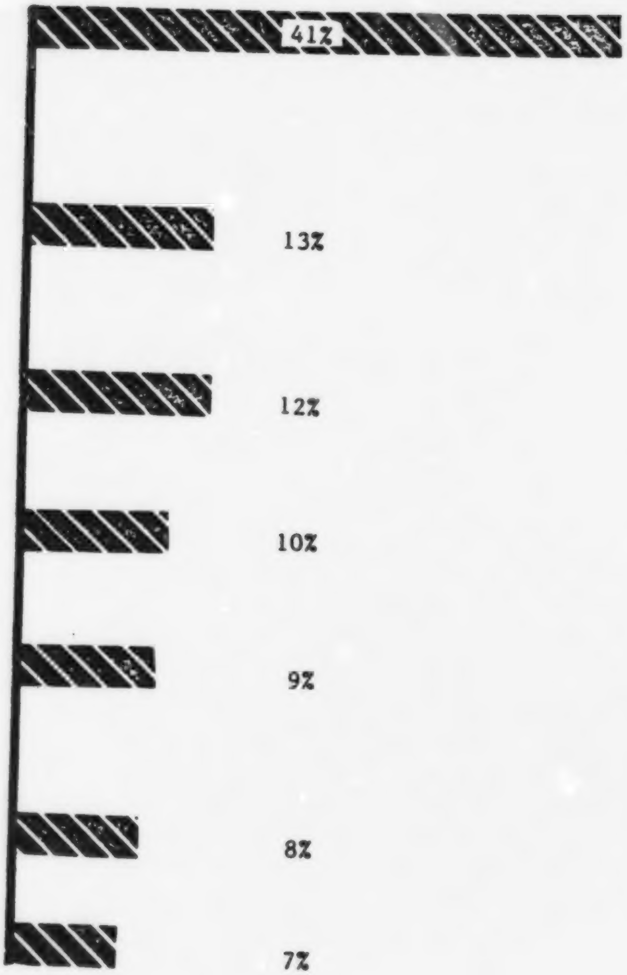
Source: Reference (10)

## TECHNOLOGY SELECTION CRITERIA: MONENCO

- Proven technology - demonstration that the technology is proven, i.e. has been operating satisfactorily on a similar scale and in a similar application for at least 12 months.
- Performance - the ability of the process to perform, its inherent efficiency, and the characteristics of effluents, emissions and residues.
- Flexibility - the ability of the process to accommodate variations in both waste quantity and quality.
- Reliability - the complexity of the process and its vulnerability to breakdown. Includes spares and maintenance requirements.
- Safety - occupational and environmental safety during normal and abnormal operating conditions.
- Operations - operational complexity, degree of automation, calibre of staff required and availability of staff training and startup assistance.
- Canadian and Ontario benefits - ability to utilize local resources for the engineering, supply, and construction of the Facility. Includes long term technology transfer.
- Commercial and economics - includes capital and operating costs.

Source: Reference (33)

# TECHNOLOGY SELECTION CRITERIA: ARTHUR D. LITTLE, INC.



| Criteria | Weights |
|---|---|
| Abnormal Events - Maximize protection of worker and community health and safety in the event of an abnormal occurrence | 41% |
| Normal Events - Maximize protection of human health and the environment under normal operating conditions | 13% |
| Operational Reliability - Maximum reliability of process equipment | 12% |
| Technical Reliability - Maximize ease of operation and monitoring | 10% |
| Input Flexibility - Maximize effectiveness of treatment for different types of wastes and varying waste composition | 9% |
| Operational Flexibility - Maximize ability to start and stop treatment as needed | 8% |
| Cost - Minimize relative operating cost | 7% |
| TOTAL | 100% |

# APPENDIX C

## AD HOC RANKING OF CONCEPTUAL ALTERNATIVES

As described in Chapter 4, the study team used a matrix format to rate alternatives against criteria, relative to OWMC's proposal. The matrix developed is reproduced in Figure C-1. Symbols are explained in Chapter 4. To obtain a preliminary rank ordering of alternatives, the team assigned the following numerical values to each of the symbols:

| Symbol | Assigned Number (N) |
|---|---|
| >> | +2 |
| > | +1 |
| >\|= | +1/2 |
| = | 0 |
| <\|= | -1/2 |
| < | -1 |
| << | -2 |

An ad hoc numerical score (Si) was then assigned to each alternative (i) using the following formula:

$$Si = \sum w_j \, Nij$$

where $w_j$ is the weight assigned to criterion j and Nij is the number assigned to rate alternative i against criterion j. The overall score Si is calculated by summing the product $w_j$ Nij over all criteria used. The results of this exercise were as follows:

| ALTERNATIVE (i) | ALTERNATIVE DESCRIPTION | AD HOC SCORE (Si) |
|---|---|---|
| 1 | OWMC's Proposal | |
| 3A | Centralized OWMC Incinerator, Physical/Chemical Treatment and Solidification Facility with Private Landfill | -7.5 |
| 2D | Many Decentralized Physical/Chemical Treatment Units with a Single Incineration and Landfill Facility | -8 |
| 3C | Centralized OWMC Incinerator, Landfill and Solidification Facility with Private Physical/Chemical Treatment | -14.5 |
| 2C | Decentralized Separate Treatment and Disposal Facilities | -15 |
| 6 | Active Support of Private Sector | -18 |
| 2A | Decentralized Comprehensive Facilities | -24.5 |
| 2B | Decentralized Specialized Facilities | -32 |
| 3B | Centralized OWMC Incinerator Facility with Private Physical/Chemical Treatment and Landfill | -32 |
| 5 | Continued Active Four R Program as OWMC's Only Role | -33 |
| 4 | No Action | -49 |

This ad hoc ranking guided the discussions of the study team, but was not accepted as the final ranking. the principal reason is that the assignment of numbers to symbols is no more than a convenience. For example, Alternative 4 was rated much worse (<<)than OWMC's proposal on criterion A1; alternative 3B was rated worse (<) than OWMC's proposal on the same criterion; but there is no reason to conclude that alternative 4 is exactly twice as bad as Alternative 3B on this criterion. The ratings were strictly qualitative and the criteria were not generally amenable to precise quantification.